THE INANGAHUA EARTHQUAKE: AN APPLICATION OF THE POWELL AND RAYNER MODEL OF DISASTER-TIME

by

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When a writer thinks he has left behind all the problems that confronted him during the period of his research, he is faced with the one problem to which there does not seem to be any easy solution. That is the problem of acknowledging all those who aided (and abetted!) him during the course of his work.

It is a problem I face because the number of people with whom I am I am indebted are too numerous to thank personally. The help they gave was of such immense value that this work would not be the same without their information, expertise, advice and support.

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N.R.B.

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ABSTRACT

This study is a contribution to research within the sociology of disasters. The material is presented in two inter-related parts. The first four chapters provide an introduction and a background to disaster research from a sociological perspective. This portion of the study also provides the framework - Powell and Rayner's (1952) model of Disaster Time - upon which a specific disaster will be considered.

The disaster which this research focusses upon is introduced in the fifth chapter, that is, the May 24, 1968 Richter 7 magnitude earthquake centred 15 kilometres north of the township of Inangahua in the South Island of New Zealand.

Briefly, the contents of the study are:

Chapter I introduces definitions and discussions of Natural Hazards, Natural Disaster, and Collective Stress Situations. Chapter II is devoted to a discussion of one of the most formidable natural hazard agents - earthquakes. This discussion of earthquakes is directed primarily on the New Zealand situation.

The orientation of Chapter III is (a) to provide a discussion of the sociological perspectives as they apply to disaster research; (b) to introduce a discussion of the variables that a researcher has to consider when analysing a

disaster; (c) to present examples of sociological models of disaster time, and a model of disaster space, and, (d) to introduce the Powell and Rayner model of Disaster Time.

Powell and Rayner in 1952 proposed a descriptive scheme for a disaster, based on a formulation in terms of developmental stages. They characterised each stage by its own integrative mechanisms, distinctive variables, and a set of unique tasks for each of the various actions of the affected social system. The stages developed by this model are: the Pre-Emergency Phase, which consists of a Pre-Warning stage; the Emergency States, comprising Warning, Threat, Impact, Inventory, Rescue and Remedy; and a Post-Emergency Phase, which they termed 'Recovery'.

Chapter IV presents a discussion of the methods used in disaster research. This chapter also contains the methods used in the analysis of the 1968 Inangahua Earthquake, from which this study is a result.

Chapter V begins with information about the Inangahua region - a short history of the Inangahua region; counter-measure agencies in the Inangahua area; an attempt to assess the 'West Coast character'; a brief discussion of earthquakes in the Inangahua area. Against this background, and within the framework of Powell and Rayner's model, the earthquake of 1968 is reviewed.

The final Chapter (Chapter VI) entitled, 'Reflections on the Powell and Rayner model of Disaster Time', looks at problems applying the model; the limitations of the model; the strengths of the model; and the application of the model to earthquakes.

CHAPTER I

NATURAL HAZARDS, NATURAL DISASTERS AND COLLECTIVE STRESS SITUATIONS

1.1 Natural Hazards

According to Zimmerman (1957), the physical environment is "neutral" and it is human culture that determines which elements are considered to be resources or resistances. A natural hazard can be considered a resistance because of the adverse effect it can have on human society. Russell (1969) says:

> "At first glance there would seem to be one clear difference between hazards and non-hazards for a particular time, place and population. That is, hazardous events tend to be extremes found far out in the tails of relevent probability distributions of the particular kind of event. Hazards can be defined only in terms of their impact on human society, and hence they must be seen as the joint product of natural events and existing adjustments to those events. Since hazards are so named because they cause economic and social disruption, the level of economic activity in an area, the institutional framework of the society in that area and the previous decisions about specific adjustments to the natural event in question are all involved in assessing what events are of a hazardous character".
>
> (1969:4-5)(see also White 1974:3; Kates et al 1973:3; Burton and Kates 1964; Wenger 1978:26).

Hazards are those events, geophysically produced, that are atypical in human society and cause social disruption, economic loss, death, or injury to members of that society. A rainy day or a cold westerly airstream for instance, are not hazards unless they are present for a prolonged period of time, or are unexpected in their occurrence. These events may lead to, in this example, flooding or snowstorms. Rain and snowstorms are frequent occurrences at particular times of the year for particular societies and on the whole, these societies are organized to cope with the natural agent. A natural event becomes a hazard only when it is produced by an abnormal or a prolonged geophysical or climatic phenomenon. The probability of it raining in New Zealand tomorrow is relatively high but the probability of an earthquake occurring that devastates an inhabited area is lower although New Zealand has over 300 earthquakes per year. It is only when the rainstorm reaches flood proportions, or when a shallow-focus Richter magnitude 6 (or over) earthquake occurs, does it become a natural hazard and/or a natural disaster.

Associated with the result of such natural events is the fact that these events are less common, thus the probability is more remote of their occurrence. Because the probability of a hazardous event occurring is less than that of more frequent geophysical/climatological events (for example a Richter 3 earthquake or a rainy day), these more extreme events are hazards because society usually has not adopted sufficient mitigation measures as it has done for the more frequent geophysical/geological events (such as storm drains on roads to disperse surface water).

For a working definition of 'natural hazard', Burton and Kates propose the following:

> "Natural hazards are those elements in the physical environment, harmful to man and caused by factors extraneous to him".
>
> (1964:417)

Kates goes on to expand this definition and states that a natural hazard

> "is an interaction of man and nature, governed by the coexistent states of adjustment on part of the human use system and the state of nature in the natural events system. In this context it is those extreme events of nature that exceed the capabilities of the system to reflect, absorb, or buffer that lead to the harmful effects, oft-times dramatic, that characterize our image of natural hazards".
>
> (1971:438)

This definition implies that a natural hazard is determined by the technological level of the society in question. Kates (1971) provides verification of this suggestion when he states:

> "Human response to natural hazard is organised into three distinctive techno-social patterns or stages of adjustment: folk or preindustrial; modern technological or industrial; and comprehensive or post-industrial. Each stage is marked by a preferred cluster of adjustments, a distinctive process of choice and characteristic patterns of damage occurrence".
>
> (1971:339-440)

The expansion of Kates' typology of societal distinctions and adjustments to hazards is as follows (for a schematic representation, refer Figure 1):

1) Folk or Pre-industrial Societal adjustments for example, are often mystical, irrational or imbedded in the broader cultural context of life and livelihood (i.e. tradition). These adjustments require more modification of human behaviour in harmony with nature than reliance on the control of nature .

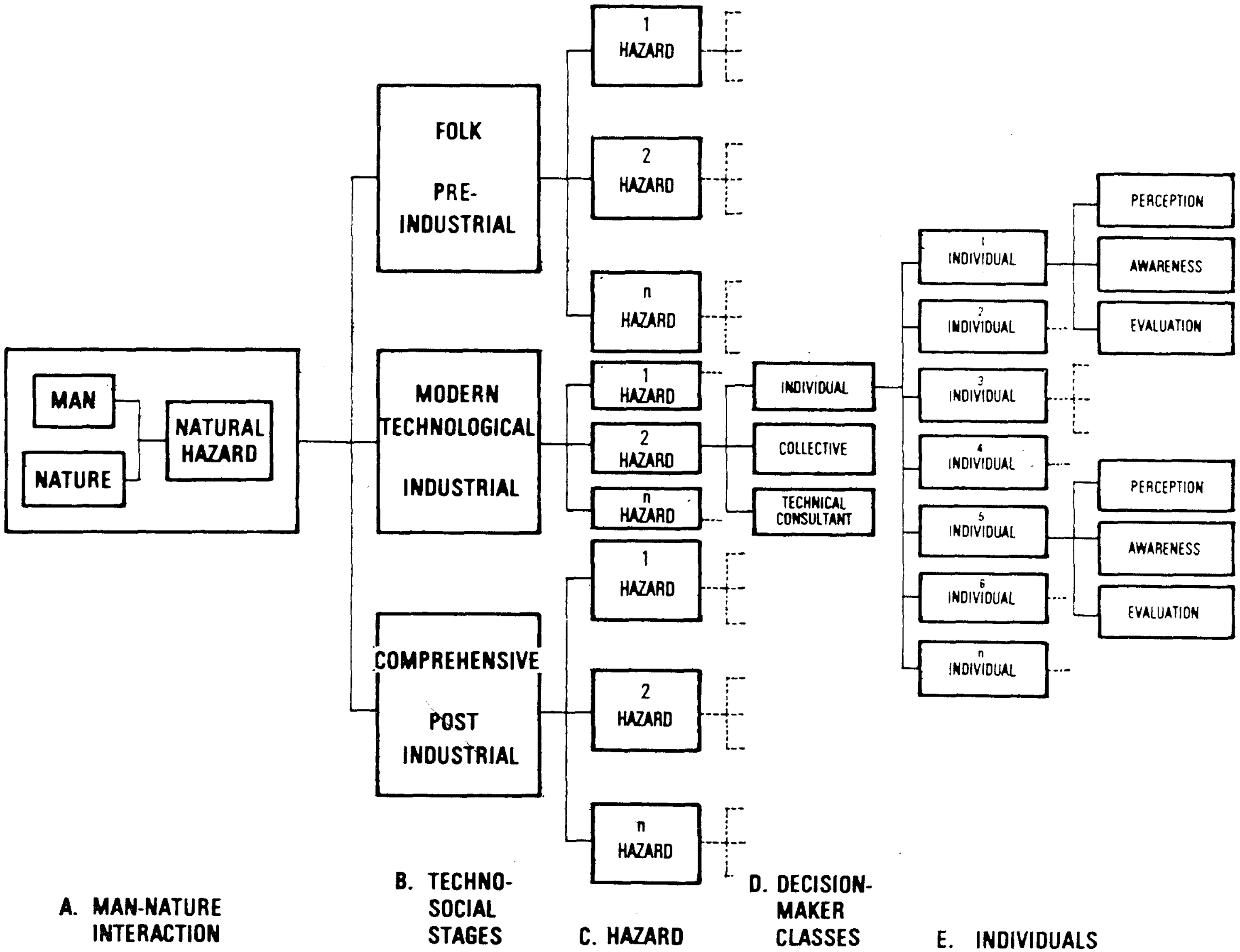

FIGURE 1: TYPOLOGY OF SOCIETAL DISTINCTIONS AND ADJUSTMENTS TO HAZARDS

Source: Kates R.W. in ECONOMIC GEOGRAPHY 47, p439

They are inflexible and easily abandoned. They are low in capital requirements and require action only by individuals or small groups. Damage-causing natural events appear to be frequent,the average loss per event is low, but the ratio of deaths-to-damage is high.

2) Modern Technological or Industrial adjustments involve more or less conscious decisions from a limited range of technological actions emphasising control of nature. These adjustments are inflexible and difficult to change. They are high in capital requirements, require interlocking and interdependent social organisation and tend to be uniform. Damage-causing natural events become less frequent, death rates diminish, but average damage loss per event is extremely high.

3) Comprehensive or Post-Industrial adjustments combine features of both earlier stages so as to involve a larger range of adjustments, greater flexibility and variety of capital and organisational requirements and the institutionalization of broadened choice from the array of potential factors (i.e. building codes, disaster subcultures). Damage-causing natural events increase, death rates diminish, and the average damage loss per event decrease by up to half the maximum potential damage. Nevertheless, absolute danger and deaths may remain high as a function of increase in population and wealth.[1]

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[1]Wenger refers to a two-dimensional belief system about the relationship between human behaviour and natural forces. His "unicausal, passive and deified" belief system corresponds to Kates' Folk or Pre-Industrial society; whereas Wenger's "complex, activistic, naturalistic causal beliefs" can be seen to correspond to Kates' second and third classifications (Wenger 1978:20).

Within this typology it is suggested here that New Zealand is still in the modern technological or industrial stage. Daniel Bell, one of the prime exponents of the post-industrial society concept, stated five main dimensions that characterize postindustrial society:

1) the predominance of service-production over goods-production;
2) the pre-eminence of the professional and technical classes;
3) the centrality of theoretical knowledge as the source of innovation and policy formation;
4) the planning and control of technological growth; and,
5) the creation of a new intellectual technology which is grounded on rationality and which provides the basis of a new mode of decision-making (refer Maskell, 1977).

Maskell also concludes that New Zealand cannot be termed a post-industrial society, but changes are occurring, notably the growth of the service and the professional and technical occupational groups which would suggest that New Zealand's future lies in such a direction. Bell's dimensions of post-industrial society are not perhaps as fully developed in the New Zealand socio-economic system as they are in the United States of America (Maskell 1977:11). With reference to natural hazards adjustments, New Zealand society at present does not possess adequate institutionalized mitigation methods for reducing the effects of a natural disaster (Britton, 1979).

Elaborate technical and social mechanisms enable man to seek from nature that which is useful and to buffer that which is harmful to man. To cope with the harmful effects of nature, sets of human adjustments are found in all human use systems (for example, seismic resistant buildings, flood dykes and levees, land-use patterns). By chance, or even by design, these adjustments can prove insufficient to cope with a given set of natural events and serious detrimental effects may ensue. But the character and/or magnitude of a hazard may be altered by man's actions: there is little hazard from flood if man does not inhabit or use floodplains. Where man builds or lives with reference to the location of potential extreme geophysical or climatic events determines the character and extent of hazards to man. The extent of the hazard is also a function of how man builds. Man can live in some areas of high seismic activity if he designs and builds his structures with adequate seismic resistances. Great earthquakes may come, but casualties, economic losses and social disruption can be minor. Hazards can be reduced, even if not completely eliminated in some instances. This ties in with Miletti *et al*'s (1975) use of the term 'hazard', which they discuss in relation to man and his activities to future extreme geophysical events. The occurrence of a specific natural event may or may not have any impact on the human use system, this being the function of the size of the event and the character of the adjustment. Thus natural events are not seen in a vacuum. They are seen as having certain effects or consequences, and it is rather the consequences that are feared than the hazard phenomenon *per se*.

To complicate the matter further, the rise of the urban-industrial society has been coincident with a rapid increase in a type of hazard which may be described as 'quasi natural'. These hazards are created by man, but their harmful effects are transmitted through natural processes. Thus, man-made pollutants are carried downstream, ocean-plying oil tankers break-up or collide spewing their cargo into the sea creating ecological problems on the coastline, radio-active fallout is borne by air-currents, and pesticides are absorbed by plants leaving residues in foods. (For an elaboration on man-made disasters, refer Turner 1978).

Kates has provided a schematic representation of the effect and adjustment to natural hazards (see Figure 2)(1971). His explanation of the schema is as follows:

> "For some bit of the earth's surface, for some small moment in time, man and nature in the form of a human use system and a natural event system, interact to pose a natural hazard. The existence of such hazards generates a specific set of hazard effects and its own homeostatic control governs the adoption of adjustments that modify the human use system, modify the natural event system and modify the hazard effect through emergency adjustments".
>
> (1971:444)

One implication within Kates' schema is that the social system is in a state of 'balance' or equilibrium prior to the onset of a hazard. Kates' model of the 'human use system' (i.e. the social system), suggests it is a static model, not one of change. The modification that Kates suggests, occurs as a result of the interaction between the human use system and the

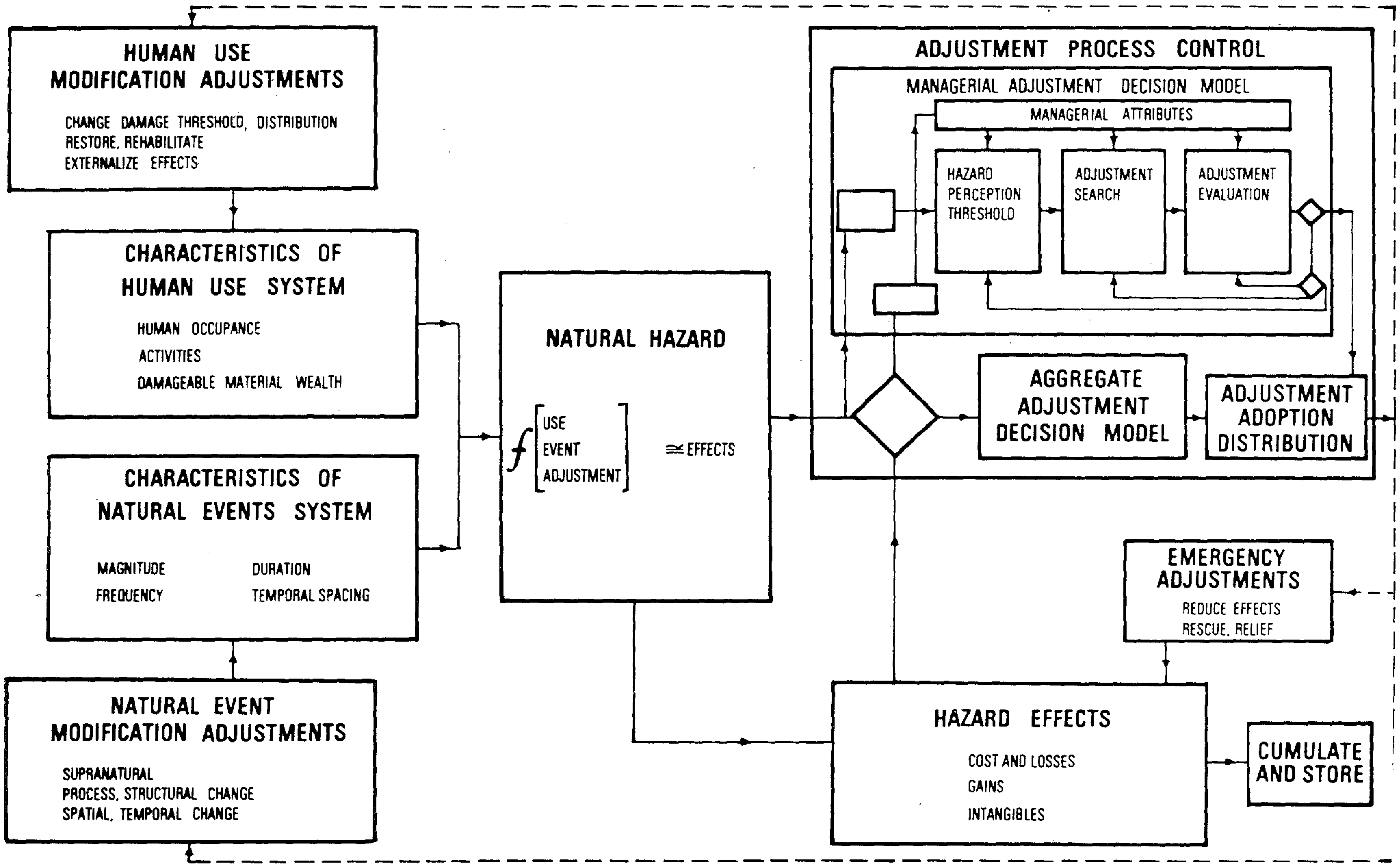

FIGURE 2: THE EFFECT OF AND ADJUSTMENTS TO NATURAL HAZARDS

Source: Kates R.W. in ECONOMIC GEOGRAPHY 47, p444 natural event system present problems of another kind - that of 'within system containment'. Change in this representation of Kates, occurs only within the parts of the (human, natural) systems that have been identified as influencing the outcome of the interaction between the human use system and the natural event system. Change is not identified as being caused by any 'external' agents or from any sources not identified in the model (e.g. from 'without').

It may well be that objectively, a social system will be in a state of non-balance. A system can be out of balance due to a number of reasons (e.g. economic or fiscal problems, lack of hazard mitigation devices, no land-use control etc.). But a system can only be out of balance if it is perceived to be out of balance by the people within that system. As Kastenbaum states:

> "The concept of disaster requires a background of relative stability and normality - that is a 'non-disaster' background. An event would not, and could not be singled out as a disaster or catastrophe if chaos and threat reigned at every stage and at all times".
>
> (1974:66).

Referring back to Kates' diagram, presumably the emergency adjustments will, if the threat is repetitive or of severe devastation, become part of the now-permanently remodelled human use system (e.g. the imposition of new building codes for high-rise buildings following a destructive earthquake) that will remain characteristic of the human use system until such times as technological innovation supercedes the existing adjustments or until another devastating earthquake forces further change (due, for example, to public pressure on local or national government). Of course, the adaptation process within the human use system is not this simple. There are many intervening variables that come into effect before adjustments are finally adopted (such as conflict of interests; persuasion of alternatives; or unwillingness to do anything by the power elite within that particular society; the state of technology; perceived frequency of a disastrous natural event; and the fiscal means to develop adjustments).

One should note that this model, along with other writings on natural hazards and disasters, defines a 'hazard' only if it affects human use and/or occupance of an area. If there is no occupance or established use of an area, a geophysical event such as an earthquake, hurricane or flood would not be regarded as a hazard. In order for a geophysical/climatic phenomena to become a hazard, both the event and human proximity to that event must be present.

1.2 Natural Disasters

The distinction between the concept of hazard and that of disaster lies basically in the time perspective. Hazard refers to a potential set of events. Disaster is a descriptive label for what is happening or what has already taken place. One of the basic problems in the analysis and study of disaster situations is the defining of the term 'natural disaster' or, more precisely, Barkun's "homeostatic disaster" (Barkun 1977:220). The word 'disaster' has more than half-a-dozen meanings ascribed to it, ranging from a limited disruption of human activity, to the physical destruction of a natural catastrophic agent, to the dislocation and lack of co-ordination in personnel and resources during the various stages of disaster emergence (refer Westgate and O'Keefe, 1976). To the United States Office of Emergency Preparedness, disaster is the

> "..occurrence or immediate threat of widespread or severe damage, injury or loss of life or property resulting from any natural or man-made cause".
>
> (1972:8).

Other authors have defined disaster more quantitatively. Sheehan and Hewitt, for example, in their pilot survey of global disasters for the years 1947-1967, described a major natural disaster as an event satisfying one or more of the following criteria:

1) it caused at least $1 million in damage, or
2) killed or injured at least 100 people. (1969:11)

Michaelis considered "accident" as events in which at least one person but no more than 999 people were killed or injured, or placed in imminent danger of being killed, whereas 'disaster' similarly involved 1,000 up to 1,000,000 persons, and the term 'catastrophe' was reserved for events killing or imminently endangering one million or more individuals (1972:4-14). Such quantitative definitions of disaster are of limited use for a description of the disaster situation. Definitions such as Sheehan and Hewitt's, and Michaelis' miss out the most important factor in a disaster situation, that is, disasters are the disruption of normalcy, it is an event which seriously disrupts normal activities. Such a disruption can occur whether or not $1 million in damage has resulted or if less than 1,000 people are dead or in imminent danger of death. Although such definitions as the above include one of them most important features of disaster - that is, that disasters are about people, 'primarily a lot of people' (Westgate and O'Keefe, 1976:46), this is only a partial definition of disaster.

In the everyday common-sense definition, disaster is thought of as mass destruction of property and extensive injury and/or death to persons. This definition is dependent on the social setting in which the disaster is seen to occur. Massive damage to property and persons on a battlefield is not considered disaster, because the general consensus accepts these consequences as the results of warfare. A military disaster occurs only when the social organisation of the Army breaks down or does not operate in an efficient or integrated manner (Form and Nosow, 1968:11), or, alternatively, when your side loses. The difference between disaster and non-disaster is that under disaster conditions, social organisation in some way becomes disrupted. Disaster therefore, may be defined as a condition in which the established social life (i.e. the routines of social living) of a community or a section of that community abruptly ceases to operate effectively as perceived by the community and/or outside inhabitants, and is severely disrupted through an excess of forces external to that system. These external forces, when referring to a natural disaster, are the result of some geophysical event, such as an earthquake, tsunami, landslide and the like, or some climatological event such as a flood, blizzard, tornado, cyclone and hurricane. A disaster situation also suggests that the crisis management capability of the community has been exceeded with the existence and utilization of extensive emergency plans and resources within the community being exhausted (refer Wenger 1978: 27-8). A more specific definition of disaster is an

> "...event, concentrated in time and space, in which a society or relatively self sufficient part of a society, undergoes severe damage and incurs such losses to its members and the physical structure that the social system is disrupted and the fulfillment of all or some of the essential functions of that society is prevented".
>
> (Endleman 1952).

Miletti _et al_ in their 1975 publication also use this definition for their description of disaster (1975:4). This definition centres on large-scale social systems and on matters of:

1) biological survival (subsistence, shelter, health);
2) order (division of labour, authority patterns, cultural norms, social roles);
3) meaning (values, shared definitions of reality, communication mechanisms); and
4) motivation within those systems.

If an event is disrupting to individuals or small groups, but does not disrupt the social structure or network of a given society, it may be considered an emergency (Wenger 1978:27) or an accident, or possibly, an upsetting incident, but not a disaster. An event can be called a disaster if all the four factors stated by Miletti *et al* were adversely affected in a particular society.[1] The focus of natural disaster then, is twofold; it relates to the disturbance, disruption and destruction of the lives of members of a community, but it must be seen within the context of the disruption and/or destruction of a social system which normally functions to supply the needs, to order the relationships, and to handle the ordinary emergencies of people in that community. Moreover, the disaster agent is understood to be external to that community (Beach 1967:12) and the situation is such that the people involved have little or no immediate control. Beach also states that there are a number of large-scale emergencies which do not 'qualify' as disasters as the latter term has been defined. The broad definition of disaster could be accepted, Beach states, but this would detract from the purpose of a definition which is of analytical value and enables one to focus attention and to facilitate communication, not to cover everything one can think of. The word 'emergency' is perfectly adequate to cover all instances of extreme situations; the word 'disaster' is then reserved for special kinds of 'emergencies', the kind that would involve an external agent and its widespread disruptive effect on a community or a significant part thereof (1967:13).

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[1] Similarly, Warren's list of normal community functions (production-distribution-consumption; socialization; social participation; social control; and mutual support), could be used as a criteria for determining whether a disaster situation had developed: if the above five functions were unable to be performed, the community could be considered to be in the throes of a disaster situation. If the agent of that upheaval was a geophysical/climatological phenomenon,then a natural disaster has struck (see Wenger 1978:19). It is more likely the case though, that in time of disasters, the priorities of these five functions will be altered, a "system of functional priorities tends to emerge" (Wenger 1978:29-31).

Brown and Goldin (1973) state that there are four components of the 'ordinary' public definition of an event as a natural disaster which can be identified:

1) Those who see themselves as affected by the disaster, view it as impinging on a specific named social system that they defined as their own;[1]
2) The specific social system referred to in a disaster is taken to be differentiated, extended and permanent;
3) The occurrence is taken as external in origin and therefore is unavoidable; and
4) The occurrence is taken as sudden. (1973:42-43)

Brown and Goldin have expanded these points. The first component asserts that naming something "Disaster" presupposes the idea of organisation and society (one can refer here to Kastenbaum's comments that the concept of disaster requires a background of relative stability and normality (1974)). Thus 'disaster area' is a territorial concept, it relates to system damage.[2] The second component of the definition asserts that the reputedly affected system is something more than a network of friendly relationships or a casual encounter. It is an extended organisation in which the social elements are groups, compared to individuals, and it is an organisation to which individuals can themselves refer in establishing a generalised social identity. It is not enough that people see the occurrence of a disaster-agent as dangerous or disruptive to themselves, their families or friends. A disaster is first of

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[1]Refer Form and Nosow, 1958.

[2]Brown and Goldin (1973:43)

all a public affair: it is a destructive geophysical agent that affects all people within an area, depending on the spatial extent of the agent. Thus, while the problems of disaster may be raised in reference to the capacity of 'The System' to deliver services, they are normally formulated in terms of a threat to all or part of society.

The third component indicates that if an occurrence is taken to be avoidable, it is not a disaster. As long as the acts of a particular agent are identified as causes or conditions of avoidability, the occasion might be treated as one calling for combat, vengeance or blame, but it is not a disaster. The term 'disaster' is reserved for situations in which accountability is problematic and the agency is unintelligible. Brown and Goldin's explanation of this third component needs clarification. A geophysical agent <u>may</u> be intelligible; for instance, when an earthquake or hurricane occurs, people are aware and know the cause of the resulting devastation and it can also be an occasion for blame. If it is a flood, then why were there no stopbanks, and why did local government permit building to proceed in this area? If it is an earthquake, and buildings collapse with resulting death and injury, then whey were there not more stringent building codes?[1] Accountability then may not

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[1]Another question could be asked based on the adequacy of buildings to resist earthquakes. In the recent earthquake in California (October 16, 1979, Richter magnitude 6.5) for instance, the Imperial County Services building in En Centro was said to be earthquake-proof, and was assumed to be able to withstand the tremors expected to occur in that region. During the earthquake however, this building was substantially damaged. The resistance of this building to earthquakes was not as great as the designers and builders had stipulated, and not as great as the owners and the public thought. If there had been any deaths or injuries resulting from this building's collapse, blame may have been apportioned to the designers/ builders.

be problematic, but it still is a natural disaster (given that society or a section of that society and its members suffer negative consequences). Clarification needs to be placed on the word 'avoidable'. The situation may be unavoidable, even if blame for, and the cause of the disaster is known. The event may be a disaster because "nothing could be done to prevent it".

Finally, a disaster is seen as occurring suddenly. The term 'disaster' suggests something that appears without warning and becomes full-blown in a short time. Just as the normal conception of disaster implies that another order - the order of nature - has broken into the social order, it also implies that other processes have broken into the normal procedures and processes of the social system. In relation to the disaster, the term 'sudden' does not refer to the absolute rapidity of an event; the suddenness of a disaster points to the realisation by societal members that society, taken to be self-sustaining or uninterruptible, has been interrupted. The term 'sudden' then refers to a certain type of interruption that annuls what is taken to be the overall rationale of a social system; that of stability and the knowledge by its members that they can perform their roles because the belief that the social member is interacting with others and their roles in a'routine' fashion.

Kastenbaum suggests as a hypothesis that

> "...it is possible that society 'needs' disasters as a means of venting interpersonal and intra-personal pressures. Crudely put, this hypothesis involves projected identification of our satanic characteristics upon the forces of nature".
>
> (1974:70)

He also proposes a second hypothesis: Disaster provides a target phobia for group conversion of anxious dread into a specific fear. He explains his hypothesis thus:

> "Boundless, formless dread is an extremely painful, psychic state. Converting the nameless dread into specific fears does much to control that terror. A sort of mass phobic reaction can then establish itself around one source of jeopardy, each individuals attitude and behaviour reinforcing the others".
>
> (1974:70)

That disasters may play positive roles in social behaviour has been commented on by researchers elsewhere (for example, Fritz' 'therapeutic community' (1961)), but Kastenbaum's statement goes beyond this situation; he suggests that there are greater latent functions of a large natural disaster that may have significant repercussions for the mental health of the disaster victims.

The term 'disaster' itself has undergone a number of efforts at reformulation with varying degrees of success. Quarantelli and Dynes state that at least four references for the term have been noted: the physical agent; the physical consequences of the agent; the way in which the impact of the physical agent is evaluated, and, the social disruption and social change brought about by the physical agent and its impact. Almost all definitions use some version of this last conception.

> "In this respect definitions of a social nature have clearly taken over and replaced the very early references which were stated almost solely in physical terms".
>
> (Quarantelli and Dynes 1977:24)

The word 'disaster' has also come under 'extreme critical attack' (Quarantelli and Dynes 1977:14) because some disaster students contend that it is a residue from the sweep of history and is thus an outmoded concept in light of the 'newer' terrors[1] that have emerged in the modern world. As yet though, no statement has sufficiently defined the concept to the satisfaction of all disaster students.

We may sum up the definitions of disaster by stating the following, taken from Dynes (1970:50): There are four different groups of meaning for the term 'disaster' as it is commonly used in the literature on disaster studies:

1) Disaster often refers to the disaster agent (e.g. hurricane, earthquake, tornado, ammunition explosion, landslide);
2) Disaster also refers to the physical impact which an agent has, i.e. damage to property, loss of life;
3) Disaster can mean the evaluation of the physical event. In other words, evidences of physical damage are evaluated as being disastrous;
4) Disaster can mean the socio-economic disruption created by the physical agent.

This last definition is the one that has been used and incorporated most frequently in the sociological literature on disasters, instead of the first mentioned, which had predominance in the early history of the study. But, in a practical context, the definition of disaster adopted will

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[1]This refers to the consequences of nuclear and thermonuclear attack, but would also be due to the ways in which human society in many cases have occupied geographical areas that are prone to devastation by geophysical agents. Related to this is the fact that many areas are densely populated, thus more casualties and economic disruption could be expected.

reflect the orientation of those involved in a disaster situation. The important thing to remember is that disasters occur at the interface of extreme natural phenomena and vulnerable settlement patterns. The factor of paramount importance is population, for without people there can be no disaster. On this basis, it is a valid approach to view disaster as the extreme situation which is implicit in the every day condition of the population. It is important to define the specific disaster situation as merely an extension of the everyday situation.

We need to see disaster not just as a tragedy for the individual, but as creating a set of problems for various community organisations. A disaster tends to affect all aspects of a community in a cross-sectional fashion: governmental, legal, religious, industrial, and commercial, health, communications, welfare, educational, and other organisational aspects.

Finally, to quote Westgate and O'Keefe, to

> "...view disaster dynamically, it is necessary to consider not merely the disaster event, but also the system of activity that surrounds it, namely prevention, mitigation, warning, disaster relief, rehabilitation and reconstruction. More importantly, it means analysing in depth both the nature of the physical agent and the vulnerability of the population".
>
> (1976:37)

Westgate and O'Keefe maintain that there is no common definition of disaster, no universal scale of disaster measurement and consequently little compatability between different sets of data on disasters. We may conclude, as does Stoddard (1968), that disaster studies, even with recently generated interest, have multiplied the already ambiguous terminology rather than yield clarifying concepts and have resulted in few theoretical 'road maps'.

1.3 Collective Stress Situations

Natural disasters are part of the larger category of collective stress situations (Barton 1969:38). A collective stress occurs when a significant proportion of members of a social system fail to receive the expected conditions of life from the system. These conditions of life include

> "...the safety of the physical environment, protection from attack, provision of food, shelter and income, and guidance and information to carry on normal activities".
>
> (Barton 1969:38)

The above conditions are a general outline of what each person expects from his affiliation with a social group within a social system. But within each of these systems, different status groups within the community would anticipate and expect varying degrees of what would be 'normal activities'. Different groups within society have differing expectations, different reference groups will influence different degrees of what each person should define as 'normal activities'.

Collective stress can occur and arise from sources either inside or outside the social system. External sources include large unfavourable changes in the environment of the system - floods, drought, earthquake and attack from other systems, loss of market or sources of supply. Internal sources include the various forms of massive social disorganisation; economic breakdown such as depressions, inflation or strikes; political breakdown such as riots, banditry, revolution and civil wars; or such drastic increases in government interferences with certain citizens as mass purges, pogroms and growth in tyranny (Barton 1969:38).

It could be argued therefore, that members of a society are living in potential stressful situations nearly all the time. The stress situation only manifests itself when one of the above factors becomes a reality (e.g. inflation or earthquake), or when sufficient social members perceive one of the above variables changing in relation to its 'normal' position. It must be remembered too, that members are subjected to 'routine' stressful situations most of the time; such routine stresses as status discrepancy, work dissatisfaction, the tendency of the modern population to be transient and subjected to the social upheaval associated with mobility (leaving one's friends and familiar surroundings). The word "stress" has been defined by Selye by giving the word a specific medical meaning, referring to generalized psychological response to illness, trauma or severe environmental fluctuations (1964:11). Selye's definition of stress is effective for a large-scale (social) situation, but stress can also refer to individual or group situations such as those described above. Barton also states that collective stress situations can also include a sudden rise of expectations that the system fails to meet such as the 'revolution of rising expectations' (1969:38). Collective stress could also result within the framework of Merton's anomie theory: when there is an absence of common values in society, or there is a limitation of access to the institutionalized means to cultural values, stress may become apparent.

Different types of collective stress situations have also been discussed. The notion of consensus and dissensus types of crises have been advanced and fruitfully applied in research efforts (refer Quarantelli and Dynes 1977:23). Dissensus types of crises are conflict-containing situations where there are sharply contrasting views of the nature of the situation, what brought it about, and what should be done to solve the problem (an example of this type of crisis is the university campus disturbances in the United States and Europe in the 1960's. In natural disasters the dissensus-type situation is less prevalent). Concensus-type crises are those where there is clear agreement by the majority of the affected population on the meaning of the situation, the norms and values that should be followed (this does not imply that there will be no conflict between values within different social groups, but the consensus-type stressful situation indicates that the majority of the population collectively view the situation as a crisis and there is agreement on the activities to restore the social system back to its pre-crisis state). Natural disasters as well as those induced by technological agents are major examples of this type of crisis.

The focus of natural disaster research to be pursued in this study will be on earthquake disasters. Earthquakes are one of natures most severe hazards. Earthquakes pose by far the largest single-event natural hazard faced in New Zealand. Earthquakes may affect great areas - sometimes hundreds of thousands of square kilometres - cause great damage to structures that may be measured in millions of dollars, cause substantial loss of life and injury, and alter the social and economic functioning of the communities in the impact area. Earthquakes sometimes result in compound disasters in which the major event triggers a secondary associated event. The secondary event may be natural, such as a landslide, or may result in the failure of some man-made system, such as a dam failure, or may be a combination of both. These secondary impacts may also result in additional loss of life and injury, and may increase the economic and social cost of the disaster.

Chapter II introduces a discussion on earthquakes, particularly as they affect New Zealand. Against this background of earthquakes in New Zealand, the sociological perspectives on disaster will be considered in Chapter III. In the remaining chapters a specific disaster model will be applied to a particular New Zealand earthquake disaster.

CHAPTER II

EARTHQUAKES: A GENERAL INTRODUCTION AND THE NEW ZEALAND SITUATION

2.1 General Introduction

An earthquake is a burst of energy produced by the sudden release of stress within the ground. The state of stress is built up by the forces which mould the features of the earth's surface (refer Jordan 1971; Kahle 1974; Bett 1971; Clark Jr. 1971; Takeuchi et al 1970; Gutenberg 1951; Gutenberg and Richter 1949; Bolt et al 1975; Tatsch 1977; Heck 1965; Eiby 1957). Some, although not all earthquakes, are clearly associated with movements along visible faults in the ground (faults are breaks or discontinuities in the earth's crust). They may have depths of tens of kilometres and may extend over hundreds of kilometres. Following earthquakes associated with faults, displacement of several metres between points on opposite sides of the fault are sometimes observed. The relative displacement may be vertical or horizontal or a combination of these.

Historically our understanding of the cause of earthquakes is relatively new. By the middle of the nineteenth century it had been observed that the damage caused by many earthquakes was concentrated in a narrow zone, which suggested that earthquakes had a localised source. It was not until the San Francisco earthquake of 1906 however, that it was recognised that earthquakes were caused by slippage along a fault in the earth's crust. In a classic study conducted shortly after the 1906 San Francisco earthquake, Harry F. Reid of Johns Hopkins University discovered that for several hundred kilometres along the San Andreas fault, fences and roads crossing the fault had been displaced by as much as six metres (Boore 1977:69). Moreover precise geodetic (land surveying) surveys conducted before and after the earthquake demonstrated that the rocks parallel to the fault had been strained and sheared. On the basis of such observations, Reid proposed the elastic-rebound theory of earthquakes. Reid's theory which is still considered valid today, can be summarised as follows:

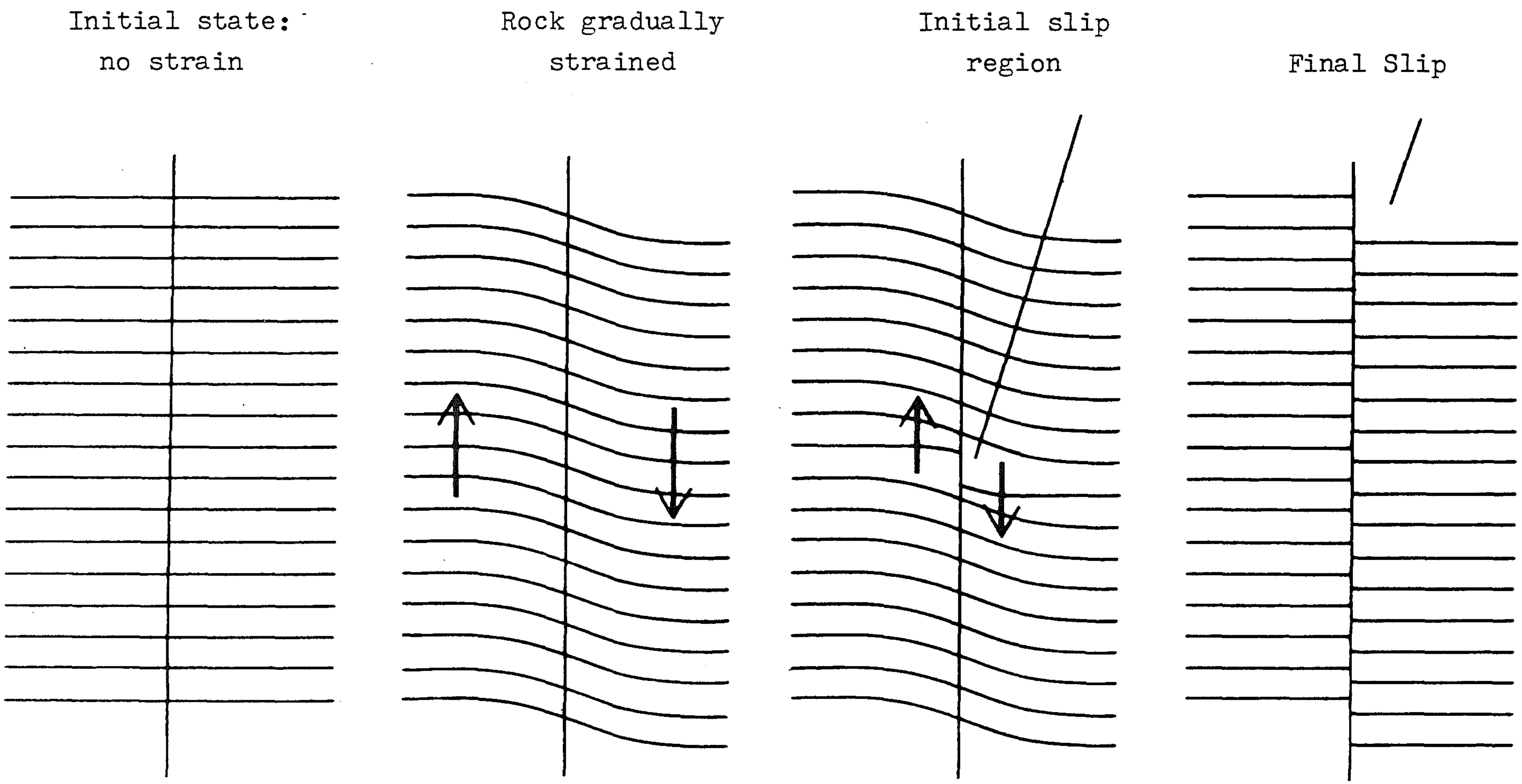
1) Relative displacement of adjacent portions of the earth's crust produces strains greater than the rock can withstand. The consequent fracture of the rock causes an earthquake.
2) These relative displacements build up gradually over a long time.
3) The sudden elastic rebound of the sides of the fracture towards their positions of no strain are the only mass movement at the time of the rupture.
4) The earthquake vibrations spring from the surface of the fracture. This surface area is initially small but may quickly expand.
5) The energy released by the earthquake is derived from the strain energy stored in the rock before the shock.

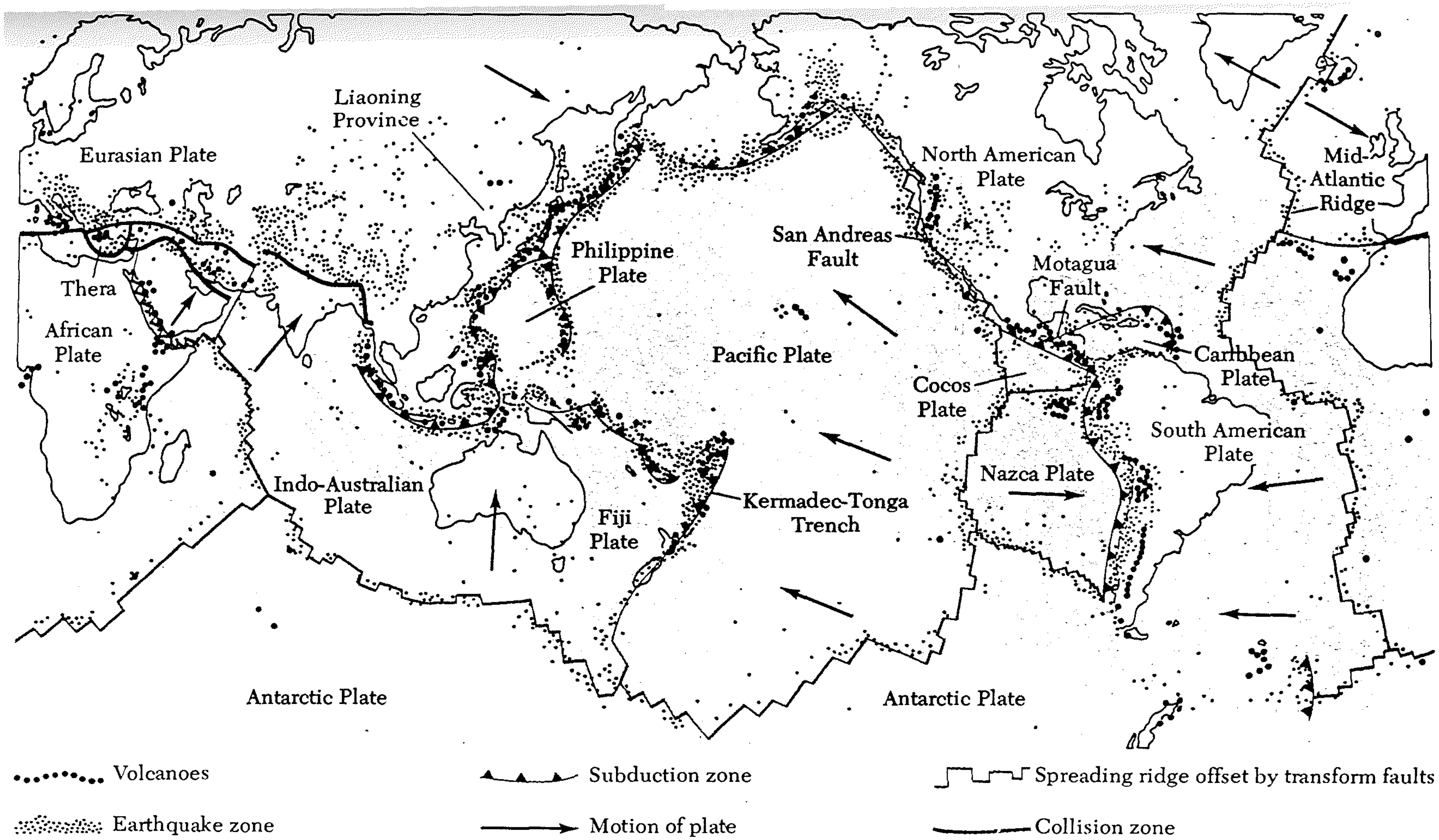
This process is shown schematically on page 29. Many earthquakes are not accompanied by a break in the earth's crust, but this model, or something approaching it, is envisaged to apply to most earthquakes.

Earthquakes are divided into three groups, depending on their depth in the ground. They are: (1) shallow, when the depth does not exceed 60 kilometres; (2) intermediate, when the depth is from 70 kilometres to 300 kilometres; (3) deep, when the depth exceeds 300 kilometres (Gutenberg and Richter 1949:10).

The vast majority of earthquakes occur along plate boundaries because of the relative motion between two plates (refer Figure 3)(Boore 1977:69-70). Most shallow mid-oceanic earthquakes are due to the jerky relative motions of two plates sliding past each other along transform faults (York 1975). The circum-Pacific belt of earthquakes predominantly lies along various trench boundaries between plates, and in this case, the earthquake shocks are a result of the downthrusting of old oceanic plate into the mantle beneath the other plate. The dipping plane along which the intermediate and deep focus earthquakes occur correspond to the great tongue of cool ocean floor protruding into the warmer mantle. These earthquakes may be produced either by slips between the tongue and the mantle or by release of stresses in the cool slab as it adjusts to its new warm environment (see Figure 4 for a diagrammatic representation of plate generation). The fact that no earthquakes occur at depths greater than 700 kilometres is now readily explained by supposing that the descending plate has

STAGES IN THE BUILD UP AND OCCURRENCE OF AN EARTHQUAKE
AS POSTULATED BY REID (after H. Beinoff)(York 1975:25)

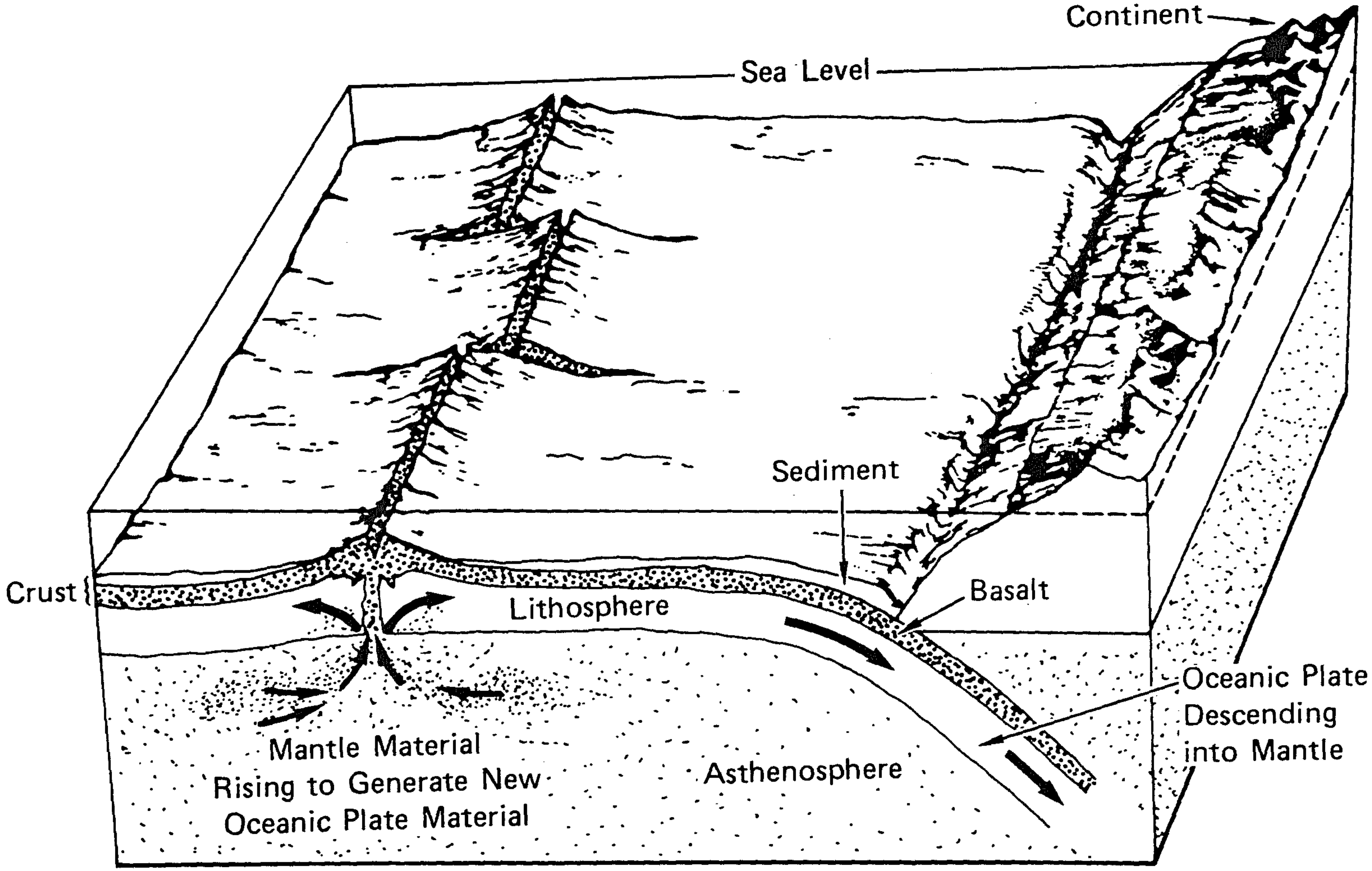




World map showing relation between the major tectonic plates and recent earthquakes and volcanoes. Earthquake epicenters are denoted by the small dots, and the volcanoes by large dots.

FIGURE 3

Source: Bolt B.A. :EARTHQUAKES: A PRIMER (W.H.FREEMAN AND COMPANY) 1978:14



MODEL OF THE PROCESS OF PLATE GENERATION AND SUBDUCTION

FIGURE 4: MODEL OF THE PROCESS OF PLATE GENERATION AND SUBDUCTION

Source: Weisbecker L.W. et al 1977:52

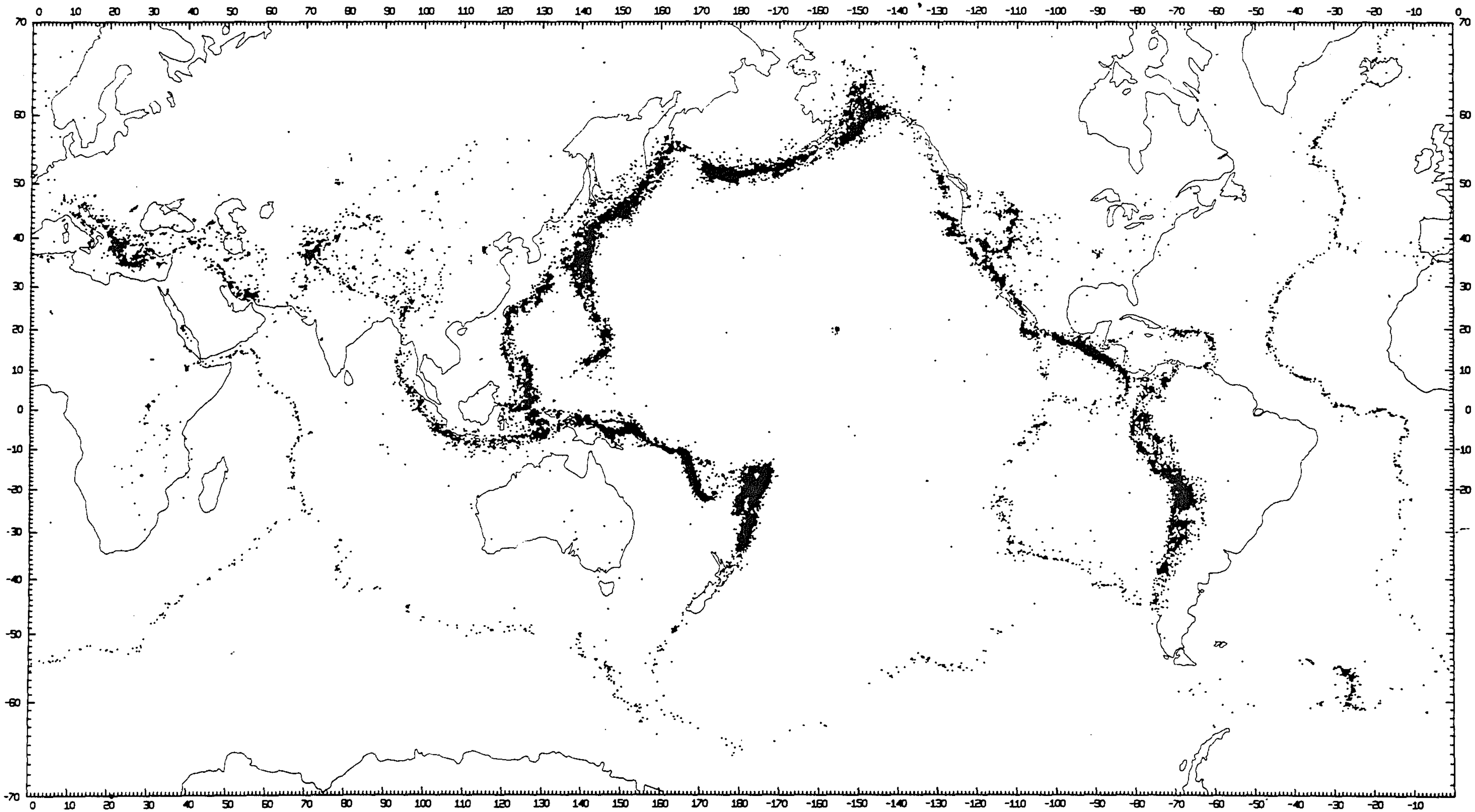
heated up to the temperature of its surrounding mantle by the time it has reached this depth and has been effectively re-absorbed in the earth's interior (York 1975:41).

The distribution of earthquakes over the earth is far from random. The vast majority of earthquakes occur along three long belts; the circum-Pacific belt, in which about 80 per cent of the earth's earthquake energy release takes place; the globe encircling mid-oceanic ridge system; and the continental fracture system which runs from the East Indies, through the Himalayas, southern Asia and the Mediterranean, finally perhaps, running out to sea to meet the mid-oceanic system near the Azores (Figure 5). The frequency of occurrence of earthquakes is well illustrated by the following table (Table 1). Evidently, there is one shock per minute of the order of magnitude 2 or greater. While the vast number of earthquakes are small ones, it should be remembered that the great preponderance of the energy released by earthquakes per year is concentrated in a few large shocks.

TABLE 1

Frequency of Earthquake Occurrence
(after Gutenberg and Richter, 1954)

	Magnitude	No. per year
Great Earthquakes	8	1.1
Major Earthquakes	7-7.9	18
Destructive Earthquakes	6-6.9	120
Damaging Earthquakes	5-5.9	800
Minor Earthquakes	4-4.9	6200
Smallest generally felt	3-3.9	49000
Sometimes felt	2-2.9	3,000,000



Epicenters of some 30,000 earthquakes recorded in the years 1961–1967, with focal depths between 0 and 700 km. [Epicenters by U. S. Coast and Geodetic Survey. Computer plot by M. Barazangi and J. Dorman, Columbia University.]

FIGURE 5: EPICENTRES OF EARTHQUAKES BETWEEN 1961-1967

Source: Press F. & Siever R: EARTH (W.H.FREEMAN,SAN FRANCISCO 1974:642

Earthquakes throughout history have ranked high among natural hazards which have caused severe damage to life and property. In the last 1,100 years there have been over 60 major earthquakes with the total deaths estimated to exceed three million (refer table 2). The earthquake problem depends not only on the seismicity of the region, but also on the population density, the character of building structures, the level of national wealth and income. Obviously, if an earthquake hit an unpopulated area it can hardly be classified as a hazard. With the assumption that the seismicity remains the same, the damage to life and property increases with increases in population and economic developments. With the increase in occupancy of hazard areas, damage from natural hazards have been on the rise for several decades. In the United States for instance, the average annual rate of increase in damages as a result of hurricanes, floods, tornadoes and earthquakes, as estimated by Dacy and Kunreuther (1969), amounts to about 2.5 per cent per annum. Compared to this, the rate of increase of earthquake damage alone has been 5.8 per cent per annum (Dacy and Kunreuther 1969:17). There has been an increase in large-scale disasters (defined as exceeding a 10 degree (latitude by longitude) area), and an increase in the number of deaths per year per million population, but a decrease in the overall number of disasters (Disaster Research Unit 1975: Paper Number 11). This decrease could be because there is a greater amelioration of extreme environmental conditions in the developed world. But Sheehan and Hewitt (1960) and Dworkin (1974) have stressed that they were employing secondary sources in their data-gathering of natural hazard statistics,

TABLE 2

Agent	Number of Disasters
Floods	269
Typhoons, Hurricanes, Cyclones	169
Earthquakes	115
Tornadoes	95
Thunderstorms	35
Snowstorms	31
Heatwaves	21
Coldwaves	13
Volcanoes	13
Landslides	21
Rainstorms	21
Avalanches	11
Tidal Waves	5
Fogs	3
Frost	2
Sand and Dust Storms	2

(Dworkin, J., Global Trends in Natural Disasters 1947-1973, Natural Hazard Research Working Paper 26, 1974.)

Agent	Number of Disasters
Floods	209
Typhoons, hurricanes, cyclones	148
Earthquakes	86
Tornadoes	66
Gales and Thunderstorms	32
Snowstorms	27
Heat Waves	16
Cold Waves	13
Volcanic Eruptions	13
Landslides	13
Rainstorms	10
Avalanches	9
Tidal Waves	5
Fogs	3
Frost	2
Sand and Dust Storms	2

(Sheehan and Hewitt, A Pilot Survey of Global Natural Disasters, Natural Hazards Research Working Paper 11, 1969.)

which contained a pro-American academic bias; thus they have not recorded many of the smaller practical situations of disaster which are not necessarily newsworthy but which do occur. The implications here are that disasters are occurring as frequently as before rather than decreasing in total numbers. A glance at Table 3 will provide evidence of the percentage increase of disaster types recorded for the period up to 1971.

TABLE 3

Disaster Average by Type per Annum

Type	1968-1971	1919-1971	% Increase
Cyclone etc.	1.75	0.62	182.26
Drought	1.25	0.13	861.5
Earthquakes	2.00	1.3	53.8
Epidemics	0.5	0.19	163.6
Flood	6.75	2.7	150.0
Volcanic Eruption	0.25	0.06	316.6
Famine	0.5	0.25	100.0

(After Baird et al: Disaster Research Unit Paper 11, University of Bradford).

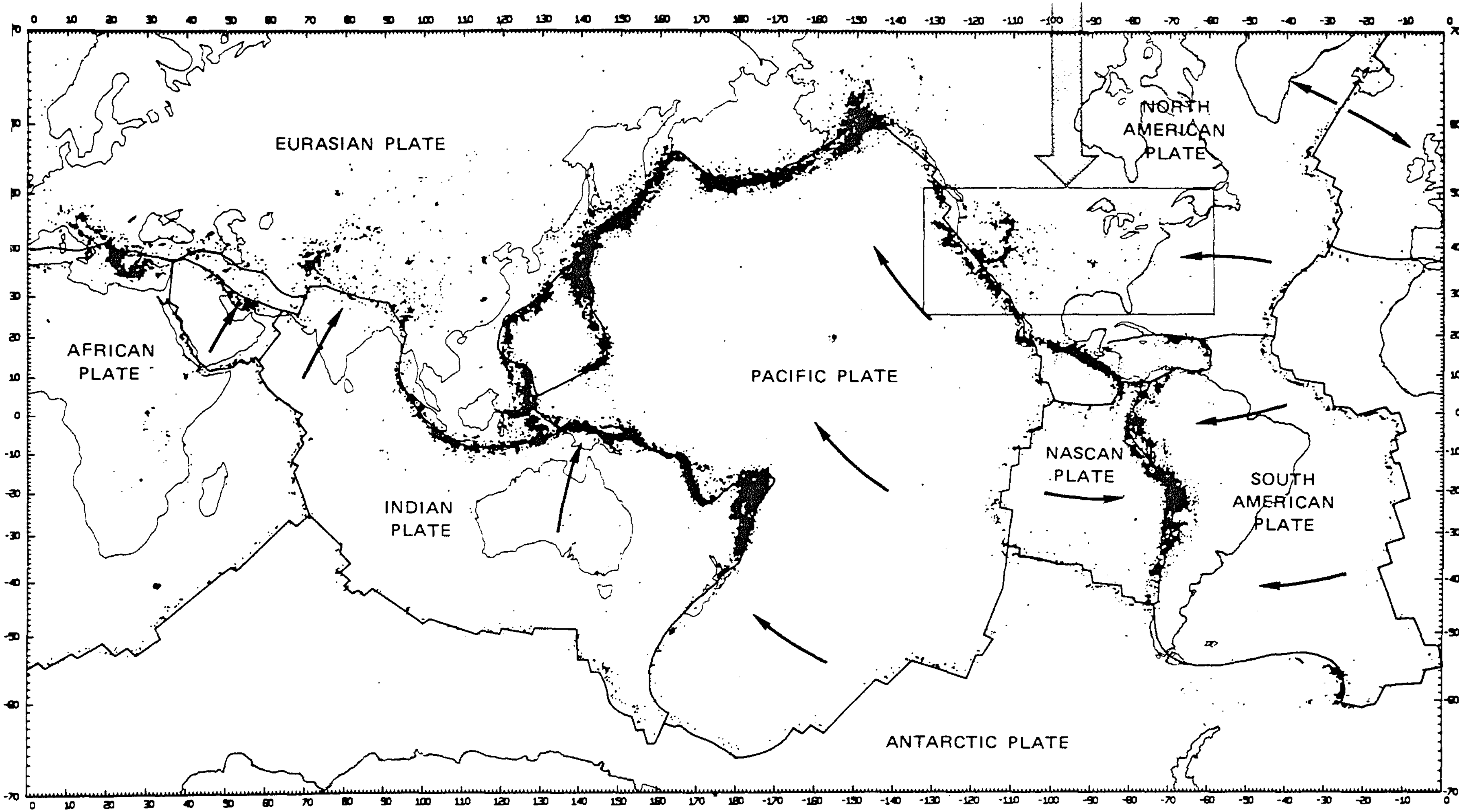
Therefore, despite the unreliability of the data, there does seem to be a general increase in disaster occurrence particularly when we consider the probability that the physical event is constant.

2.2 New Zealand

About 80 per cent of the world's shallow earthquakes, 90 per cent of intermediate and all deep shocks occur within the active belt that borders the Pacific Ocean: New Zealand lies within this active belt. It is on the boundary of the Pacific Plate and the Indian Plate, where the two-over-ride each other.

To the north of New Zealand, the Pacific Belt is dipping beneath the Indian Plate, while in the south of the country the Indian Plate is dipping beneath the Pacific Plate (Figure 6)(Fact Finding Group on Nuclear Power 1977:361). The general level of seismicity in New Zealand is fairly well established; New Zealand experiences about one per cent of the world's total earthquakes and can expect one shock of Richter magnitude 6 or more and ten of Richter magnitude 5 or more in a typical year, an earthquake of magnitude 7 every ten years, and one of Richter magnitude 8 every hundred years. The Seismological Observatory, based in Wellington, determines the epicentres for all earthquakes whose magnitudes are 5 or greater and for all earthquakes reported felt. This amounts to about 350 earthquakes recorded in a typical year. In the years 1967-1974 there were 1,454 noteworthy shocks.

Earthquake risk throughout New Zealand is widespread (refer Figure 7). According to Adams (1977), large earthquakes have occurred fairly uniformly in a band extending in a north-east to south-west direction, and the only part of the country where earthquakes of Richter magnitude 6 or more have not been located since records of earthquake occurrence began are the north-west of the North Island and the south-east of the South Island. Both of these areas however, have experienced earthquakes of magnitude 5. Thus no part of the country can be considered immune from the risk of earthquakes, although some areas have been subjected to more frequent earth tremors than others.



MAP OF WORLDWIDE SEISMICITY SHOWING LOCATIONS OF MAJOR PLATES

FIGURE 6: MAP OF WORLDWIDE SEISMICITY SHOWING LOCATIONS OF MAJOR PLATES

Source: Weisbecker L.W. et al 1977:53

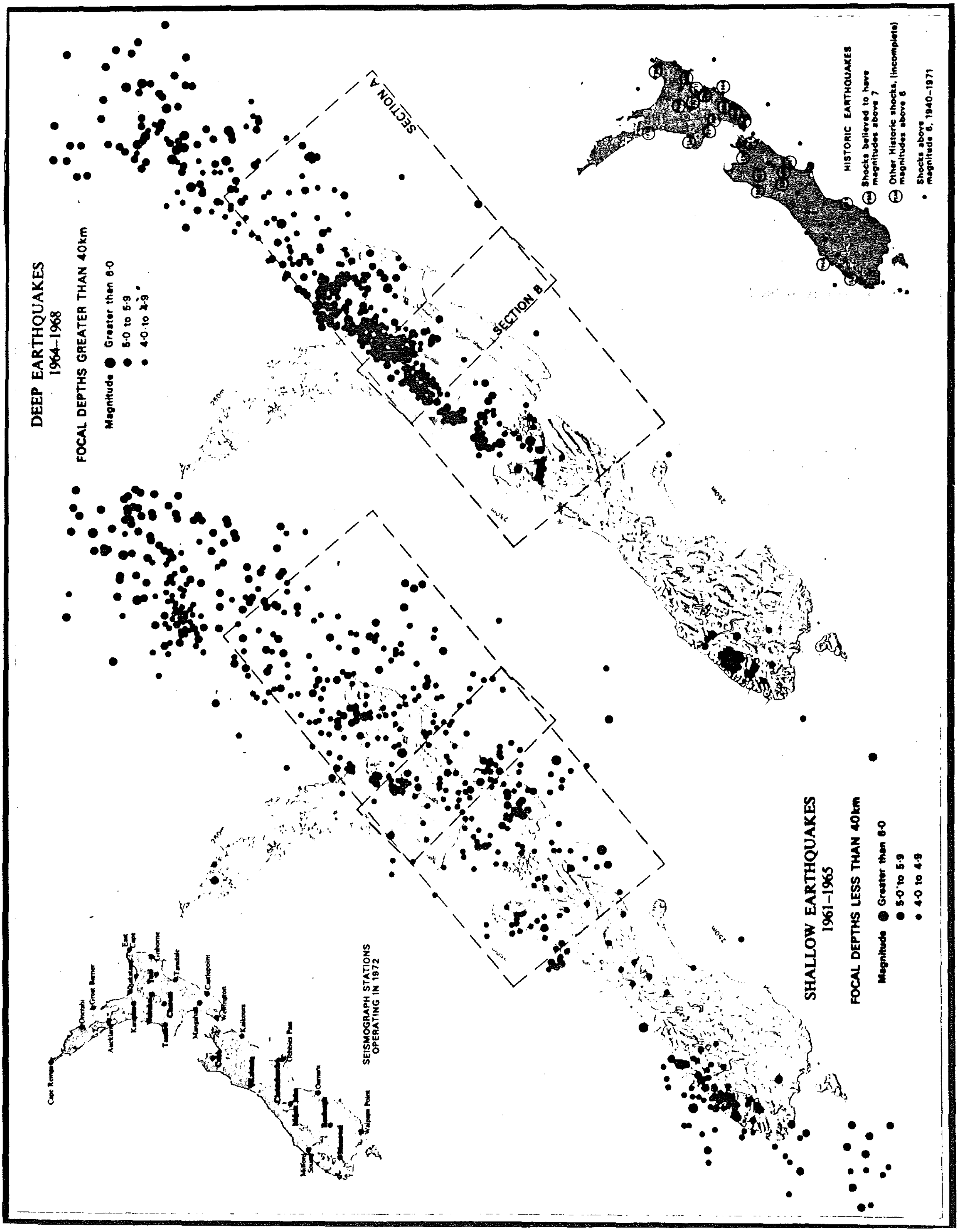


FIGURE 7: <u>MAP OF NEW ZEALAND EARTHQUAKE EPICENTRES</u>

Source: Wards I. (Edt): <u>NEW ZEALAND ATLAS</u> (Government Printer, Wellington) 1976:78

The cost of earthquakes to New Zealand can be measured in terms of life and economic losses caused by past earthquakes and by estimating future possible costs. Since 1848 deaths directly or indirectly attributed to earthquakes have amounted to 288 - 256 of these in the 1931 'Hawkes Bay' earthquake.[1] Economic costs of past earthquakes are more difficult to measure, but some cost for selected earthquakes are:

Year	Location	Cost
1848	Wellington	$30,000
1855	Wellington	$32,000
1931	Hawkes Bay	$10,000,000
1942	Wellington/ Wairarapa	$5,000,000
1968	Inangahua	$4,198,708

(After Bligh: 1972).

Note that the 1848-1968 figures are unadjusted in terms of present real dollar value. Bligh estimates that the 1848-1931 figures are 'significantly understimated'.

Paid-out claims from the Earthquake and War Damage Commission resulting from earthquake losses for the period January 1, 1945 to March 31, 1978 have amounted to an excess of $NZ10 million. The potential cost of a single future earthquake is difficult to measure precisely but a few comments can be made.

[1] The Tuesday 3 February 1931 earthquake in the Hawkes Bay region registered 7.75 on the Richter scale. The earthquake occurred in a much more densely populated area than any previous shock had done (Eiby 1957:148). The towns of Napier, Gisborne, Hastings and Wairoa all lay within the destroyed area. The business areas of Napier and Hastings were almost totally destroyed, with secondary impacts (fires) causing more damage and loss of life, (Grayland 1957:126). The earthquake occurred at 10.48 a.m. when, according to eye-witnesses the CBD was busy with shoppers (Milne 1974:18; Grayland 1957:125). A nurses' home collapsed, a home for the aged collapsed, a technical college,as well as private residences and shops collapsed, burying their inhabitants.

Power (1968) took a close check of all "available records of major earthquakes that have affected built-up areas, taking into account the particular circumstances, the nature of the ground, the state of construction and so forth" and estimated that a major earthquake centred in Wellington would result in damage costs equal to $US 2,000 million[1] (1979 estimate of the 1968 figure: Britton 1979). The effect of this on the New Zealand economy would be quite marked. The Earthquake and War Damage Commission fund, which in 1978 was $NZ 310 million, would be eliminated and, as about 80 per cent of this fund is invested in New Zealand, their sudden withdrawal could have severe dislocating economic effects. Furthermore, rebuilding would have to be undertaken by construction firms to the detriment of normal building development, extensive borrowing would be necessary from overseas, and, Power concludes, the country would be faced with a set-back to the economy that would last for as much as a decade.

This grim picture can be further heightened by noting that crustal deformation (uplift, subsidence, vertical and horizontal displacement) in the Alaskan earthquake of 1964 (Richter 8) took place over an area of 25.9 million square kilometres. The North and South Island of New Zealand covers an area of 16.9 million square kilometres: the consequence of an earthquake the size of the Alaskan shock for a country the size of New Zealand, may mean the whole area of New Zealand could

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[1] In 1978 the estimated Gross National Product for New Zealand was $14,000 million*. The total damage cost of a major earthquake centred in Wellington would represent 14.28 per cent of the GNP assuming the figure of $2,000 million is correct. (N.B. the US dollar and the NZ dollar at the time of writing was 98.68 US cents to the NZ$1.00).

* figure from National Housing Commission: The Demand for Housing in New Zealand, Part 2, R.P. 79/5, p. 41.

suffer displacement and deformation if a shallow earthquake of Richter 8 (estimated to have a return period in New Zealand of a hundred years) occurred along a fault line. Death and destruction could be catastrophic.

Table 4 provides data giving the date and location of all significant earthquakes in New Zealand, while Table 5 provides information on the approximate return period of significant earthquakes for selected areas of the country.

The area of highest earthquake risk in New Zealand corresponds broadly to the Main Seismic Region which covers the North Island and the northern half of the South Island (Figure 8). The frequency of earthquake occurrence within this region is fairly uniform so that towards its centre the likelihood of any particular locality experiencing damaging intensity increases. Localities near the centre of the region can be affected by earthquakes from all directions, whereas localities that are nearer the edges are less exposed. Within this region a shock of Richter magnitude 7 or more can be expected about once a decade, one of Richter magnitude 6 or more once a year, and one above Richter magnitude 5 some ten times a year.

For the Fiordland Region, covering the south-west part of the South Island, the figures are similar, but the area is much smaller, and there is reason to think that the proportion of large shocks may be greater (Eiby and Reilly, 1976). In neither case however, does the level of activity approach that in such parts of the circum-Pacific system as Japan, Chile or the Phillippines, and New Zealand may, in fact, be regarded as an area of only moderate seismicity.

TABLE 4

EARTHQUAKES OF NEW ZEALAND

(After Lominitz C, 1974)

Date	Epicentre	Magnitude
1460	Wellington	8
1826	Fiordland	$7\frac{1}{2}$-8
1843 July	Wanganui	$7\frac{1}{2}$
1848 October	Awatere	7-$7\frac{1}{2}$
1855 January	S.W.Wairarapa	8
1863 February	Hawkes Bay	
1881 December	Christchurch	
1888 September	North Canterbury	7
1891 June	Raglan	
1893 February	Nelson	
1897 December	Wanganui Bight	7
1901 November	Cheviot	7
1904 August	Hawkes Bay	$7\frac{1}{2}$
1914 October	East Bay of Plenty	7-$7\frac{1}{2}$
1921 June	Hawkes Bay	7
1921 September	Hawkes Bay	
1922 June	Taupo	
1922 July	Taupo	
1922 December	Wellington	
1926 November	Morrinsville	
1927 May	Nelson	
1928 March	New Plymouth	
1928 March	Mount Cook	
1929 March	Arthurs Pass	$7\frac{1}{2}$
1929 June	Murchison	7.75
1929 May	Fielding	
1931 February	Hawkes Bay	7.75
1932 September	Wairoa	$7\frac{1}{4}$
1934 March	Pahiatua	$7\frac{1}{2}$
1942 June	Wairarapa	7.1
1960 May	Fiordland	7
1968 May	Inangahua	7
1976 May	Fiordland	$7\frac{1}{2}$
1979 October	100km south of South Island	7.7

TABLE 5

APPROXIMATE RETURN PERIODS (YEARS) FOR INTENSITIES EQUALLING OR EXCEEDING MODIFIED MERCALLI SCALE VI,VII VIII AND IX AT SELECTED CITIES AND TOWNS THROUGHOUT NEW ZEALAND*

Location	MM VI	MM VII	MM VIII	MM IX
Whangarei	150	500		
Auckland	100	300	900	
Hamilton	40	150	500	
Tauranga	40	100	300	1000
Rotorua	25	80	250	750
Gisborne	25	80	300	900
Napier/Hastings	10	30	80	250
New Plymouth	15	40	100	300
Wanganui	7	20	60	150
Palmerston North	6	20	60	150
Masterton	7	20	50	150
Wellington	6	20	50	150
Blenheim	6	20	60	150
Nelson	6	20	50	150
Greymouth	20	40	90	200
Christchurch	20	50	100	250
Timaru	30	100	450	
Dunedin	150	800		
Invercargill	70	300		

*Based on historical earthquake occurrence.

Source: Smith, W.D. 1976)

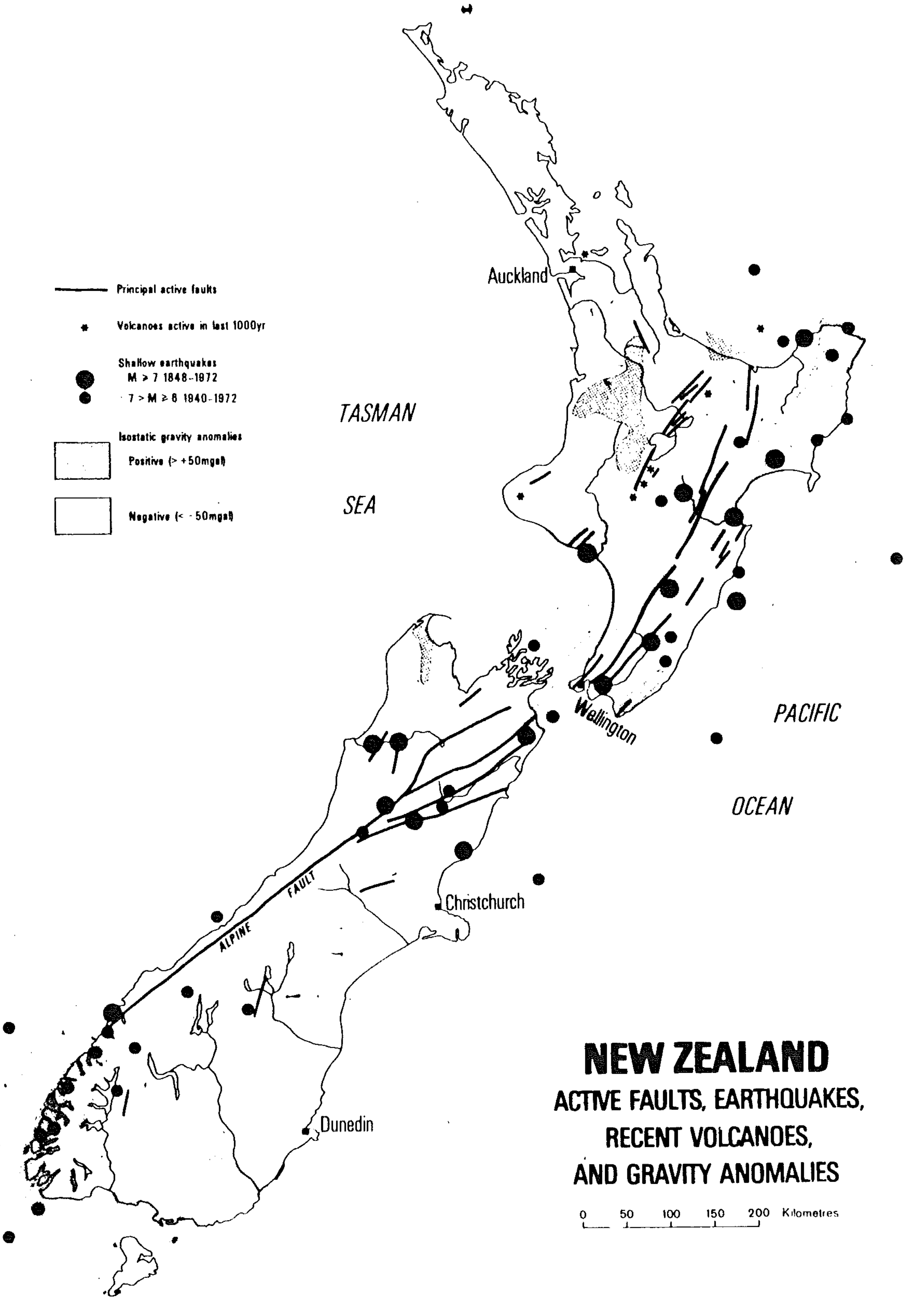

FIGURE 8: <u>NEW ZEALAND ACTIVE FAULTS, EARTHQUAKES, RECENT VOLCANOES and GRAVITY ANOMALIES</u>

Source: Courtesy of Seismological Observatory, Geophysics Division, Wellington.

Between the Main and Fiordland Seismic Regions lies a less active Central Seismic Region. Here, the average level of activity is markedly lower, but it has an intermittent character, and, during an active period a district within this Region may experience shocks with a frequency approaching that in the Main Seismic Region, while other places remain quiescent. Shocks here, and also in Northland[1] have sometimes reached damaging intensity.

2.3 A Short History of Anti-Seismic Measures in New Zealand

The existence of a seismic problem in New Zealand was recognised in 1848. Limited governmental action and pioneering were the features of this early period. There were no major disasters in the country between 1855 and 1929 and interest in earthquakes declined. Nevertheless, several papers by New Zealanders were published in the early 1920's and the schools of engineering and architecture drew the attention of students to seismic problems.

In the early years of European settlement, administrative authority lay in the hands of the New Zealand Company and its officials. The policy of the Company was to hush up natural disaster and thus help for the early settlers was not forthcoming.[2] Indeed, there were hints in the Company's reports that an inferior type of settler had put up an inferior type of building

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[1] Northland is the northern part of the North Island and has the lowest average level of seismicity in New Zealand.

[2] This was particularly the case after the July 8, 1843 Richter 7 magnitude earthquake near Wanganui which substantially damaged a number of buildings in the area.

and that any troubles they faced were no more than their just desserts. The Company's success in concealing the facts was so great that most accounts of destructive earthquakes in New Zealand still take the Marlborough earthquake of 1848 as their starting point (Eiby 1976). The 1848 earthquake which was about Richter magnitude 7 was centred in the lower part of the Wairau Valley, which was then sparsely settled, but the damage to Wellington was severe, and was augmented by the effect of two large aftershocks upon the already weakened buildings, one of which collapsed, causing three deaths. On this occasion the buildings destroyed included the headquarters of the New Zealand Company and concealment was out of the question!

The south-west Wairarapa earthquake of 1855 (Richter 8) was the greatest New Zealand shock in recorded times and it was again the city of Wellington that was most seriously affected. Many citizens who had rebuilt in 1848 had done so with some awareness that their buildings might have to withstand further shocks, and with the growth of the colony, general standards of construction had improved but there was little knowledge of principle to guide them. On the whole, the view that fire was more to be feared than earthquake seems to have prevailed in the building by-laws of the next half-century, which coincided with something of a lull in seismic activity. Christchurch twice experienced trouble with the Cathedral spire in the 1880's (December 1881; September 1888, Richter 7) as a result of earthquakes.

Before the 1920's, when isolated papers by New Zealanders began to appear in the Bulletin of the Seismological Society of America, there were few signs of local interest in the problems of seismic engineering. The belated upsurge came when the lessons of the 1906 San Francisco earthquake were brought to the memory by the Santa Barbara (California) shock in 1925. At this time most New Zealanders who thought about earthquakes at all held the view expressed by the seismologist, Dr. C.E.Adams, in the official Yearbook for 1921; that earthquakes were of scientific rather than practical importance - but New Zealand engineers nevertheless were quick to see the possible relevance of the work in California by Reid. Earthquake problems became part of the courses at the Engineering School of Canterbury College, and a series of technical lectures given at Auckland by C.R. Ford in 1926 became one of the earliest treatments of the subject in book form.

The Murchison earthquake of 1929 (June 16: Richter 7.75) was the first New Zealand shock to constitute a disaster in modern times. It involved the loss of seventeen lives and required a substantial evacuation of refugees to Nelson. Important geological investigations were made, and the effect of public opinion was to hasten the improvement in instrumental seismology. The Hawkes Bay disaster of February 1931 (Richter 7.75) had more far-reaching consequences. As in 1929, the civil defence problems were in the hands of the Police Department, with important and indispensible help from the Armed Forces and the Navy. For the first time the Government moved to impose formal legal requirements aimed at improving public safety in the event of an earthquake.

The first step was to set up a Building Regulations Committee. The direct result was a recommendation that Parliament should meet in emergency session and at once compel municipalities to pass by-laws ensuring that all new buildings were designed to withstand a minimum horizontal acceleration one-tenth of that due to gravity. Two important points were further made. The first was that requirements should be uniform throughout the country; and, secondly, that local bodies should be compelled to adopt and to police the regulations. This is a requirement successive Governments have been reluctant to enact and even now some parts of the country do not have the protection of an adequate code (in 1970 for example, only 130 of the 257 local authorities, covering approximately 56 per cent of the New Zealand population, had formally adopted NZSS 1900, the recommended standard building specification: Britton 1979).

The war brought developments in the field of earthquake engineering almost to a standstill, but there were important changes in the civil defence and the inaugaration of the Earthquake and War Damages Fund.

Civil Defence has had a curious history that has left citizens a little suspicious of its aims. The earliest civil defence measure was G.W. Forbes' Public Safety Conservation Bill of 1932, which sought sweeping powers to handle disorders among the unemployed, making it clear that in the case of 'fire upheaval, earthquake or anything of that kind' the Police were to be left in charge. The Police had performed well in both the Murchison and the Hawkes Bay earthquakes, subsequent relief and reconstruction being handled by local bodies and committees of civilians established under local body auspices. The resources and assistance of the Army and Navy played a vital part in every major earthquake from 1848 to 1942. But with the change in military emphasis from manpower to machinery and the abandonment of compulsory military training and the maintenance of reservists, the need for some alternative source of massive and disciplined help grew. Parliamentary interest in civil defence revived under the new threat of nuclear attack. In 1953 a Local Authorities Emergency Powers Act was introduced which made references to 'earthquakes, fire, flood and other natural phenomena' but it was not until 1959 when the announcement that a Ministry of Civil Defence was being set up to operate 'not only in the event of war, but also in the event of earthquakes or other natural disaster' that there were any signs that consideration other than military ones lay behind Departmental thinking. But the Ministry of Civil Defence remained a paper creation within the Department of Internal Affairs although some signs of public concern about earthquake risk was beginning to appear in the press. In 1960, the appointment of three Regional Commissioners to the Ministry of Civil Defence provided the start to a national framework, but it was not until 1968 that Civil Defence in New Zealand really came of age. The 'Wahine' storm and the Inangahua earthquake helped impress upon the public mind the value of Civil Defence and for the first time equated Civil Defence with the peace-time disaster situation rather than the disbelieved nuclear threat.

The organisation and staffing of Civil Defence, both at the national and local level, has since improved but evidence of lingering suspicions of its military past persists, including periodical suggestions that the name should be changed, and that retired Army officers should be less in evidence, still plague the organisation. But the most serious obstacle to the Civil Defence Organisation is still, as it has been in the past, the public apathy and lack of real knowledge of the function of the Civil Defence (Britton 1979: Brunton, Civil Defence Survey Christchurch 1979).

The principal gain of the war years for the mitigation of disasters in New Zealand was the establishment of the Earthquake and War Damages Commission and its consequent Fund. In 1941, Parliament authorised the imposition of a compulsory levy of 25 cents on every $100 of all fire insurance premiums. This was initially to reimburse the owners of property damaged by enemy action, but it was further provided that any money remaining after the Second World War should be transferred to an Earthquake Fund. In 1944 the premium was reduced to five cents and the Act amended to provide further monetary support from the Consolidated Fund (refer Britton 1979). The need for an earthquake insurance scheme had become apparent in the Hawkes Bay earthquake of 1931 when insurance companies paid out only £ 250,000 for losses they assessed at ten times that figure (refer Bligh 1972). The Earthquake and War Damage scheme now theoretically provides that anyone insured against fire is also insured against earthquake damage, but in reality the Fund is not substantial enough to reimburse damage caused by a sizeable earthquake in a densely population region (Britton 1979).

CHAPTER III

AREAS OF SOCIOLOGICAL ENQUIRY

3.1 Introduction

Sociologial perspectives are often classified according to whether they are micro- or macro sociological. In the former, concentration is upon individuals and small groups, focussing analysis on social interactions, the use of inductive-oriented methodology, and, to use Glaser and Strauss' term, theory is "grounded" (Glaser and Strauss 1967). In macro-sociology the focus is upon societies as a whole or on social systems (Smart 1976:12); emphasis is upon systemic, deductive and analytic research. However, this dichotomy is not viewed with absolute rigidity (see for instance, Smart 1976: 11 and 80; Mennell 1976: 139; Lenski and Lenski 1978:4).

Within the sociological study of natural disasters, micro-sociological analysis has been undertaken primarily within the Interactionist and Phenomenological frameworks. The emphasis has been placed (respectively) on the social relationships within a disaster situation and its meaning for the group or individuals involved. The Collective Behaviour focus has augmented the understanding and consequences of natural disasters. This "field of study" (Turner and Killian 1967:4) has as its area of concern the "kinds of group characterised by the spontaneous development of norms and organisation" (i.e. emergent groups) "which contradict or reinforce the norms and organisation of society" (Turner and Killian 1967:4).

At the macro-sociological "level", the tendency has been towards the use of a "systems" approach (see Quarantelli and Dynes 1977:40; Miletti et al 1975:6; see also Rapaport 1968:452). Barton (1969), for example, tries to analyse the workings of social systems under stress rather than to reconstruct the psychic processes of individuals collectively subjected to stress.

Central to both the Interactionist and Phenomenological perspectives are the inferences that people construct their everyday world through the interaction process, that the world is taken for granted and accepted as the real world, and that people live within this world and act in accordance with its socially-constructed meanings. Wolf's paper describing a group of people who have undergone a threat experience, uses a symbolic interactionist as well as a phenomenological approach (1975: 401-404). Wolf suggests though that the

> "...reality of the everyday world is nonetheless contingent upon events, and when the unexpected happens, or when a new situation occurs for which the old answers do not fit or work, this reality falls into question".
>
> (1975:401)

Fritz' article also displays this perspective; social differentiation and roles in society are patterned according to the populations perception of those roles. In a crisis situation people are forced to make critical choices (1961). Prince (1920) concentrated upon the manner in which individuals and groups responded to the dislocation of their accustomed social setting. In fact, Prince's analysis could be regarded as one of the forerunners of Goffman's "dramaturgical approach" (Prince 1968:60 and 70);(see Goffman 1975).

The phenomenological approach is a particularly relevant approach to the study of human response to natural disasters. This approach allows the researcher far better insights into the consequences of disaster for the affected population. Interactionists and phenomenologists have argued for the need to focus on the social situation and to view the social setting as those within the situation see it (Taylor 1970; Morris 1973).

Brown and Goldin define Powell and Rayner's 'disaster-time' sequence as being a phenomenological approach (1973:44, 60), as does Chapman (1967:7). In order to comprehend a situation such as the sequence of a natural disaster, the researcher has to regard the disaster as do the people who are actually involved. This is also an ethnomethodological approach because "attention is focussing largely on the structure of the shared and tacit rules and knowledge that makes interacting possible" (Gouldner 1971:320). The social world in this respect is held together by a dense collective structure of tacit understanding (what men know and know others know). Although disasters are not 'everyday life' happenings which the above two theories are more inclined to be associated with, these theoretical approaches are still applicable to the rare instances of disasters because their focus is now turned to the disruption of everyday life and how the people involved react to and regard the new situation. This approach, it has been argued, can make the normal (i.e. pre-disaster) situation and social structure clearer by exposing situations that would otherwise not be so obvious to the researcher.

Collective Behaviour theory is one of the more established traditions of studying natural disasters and their consequences. This is probably because collective behaviour emphasises the emergence of new groups or the dislocation of established groups, and this is what occurs in a natural disaster. Marx and Wood state that there has been a large amount of research into collective behaviour and 'related areas' and there has been a great amount of work on more specialised topics (1975). Included in these 'specialised topics' is research on natural disasters. The Disaster Research Center's newsletter "Unscheduled Events" is cited as an example of the specialised topics (Marx and Wood 1975). Turner (in Turner and Killian 1967) emphasises emergent norms as the essence of collective behaviour. He argues that collective behaviour should be analysed with the same model of interactive and individual behaviour as is found in institutionalised behaviour. In crowd situations the individual acts not because he/she is automatically affected by group emotion, but rather because certain lines of behaviour are seen as appropriate and new norms appear in an undefined context. Quarantelli notes that collective behaviour has traditionally been concerned with the emergence of new groups. Yet, it has focussed primarily on conflict groups at odds with, or engaged in struggles with the dominant order and has tended to ignore another common type of emergent group: that of accommodative nature. Such a group shows highly co-operative internal relations and its external behaviour seeks to be integrative (Quarantelli 1970:371). The many informal groups that arise to help during emergencies or disasters are good examples.

Collective behaviour has been instrumental within disaster research because disasters create situations in which new groups emerge and established groups may undergo a change in their traditional roles. The Disaster Research Centre (Ohio State University) has significantly advanced understanding of behaviour in disasters and has helped shatter myths about widespread mass panic and looting during disasters. Collective behaviour has often been associated with strain resulting from economic crises, war, domination, mass migration, catastrophes or unanticipated disruptive ways of life. Besides, or perhaps, there has been advocacy of a merger between different sociological perspectives on particular disaster problems. More specifically, the usefulness of combining collective behaviour and a complex-organisational perspective has been suggested (Quarantelli and Dynes 1977:33). The suggestion is part of a much larger trend in sociology; the attempt to meld the long-held traditional distinction between conventional and collective behaviour. Part of the reason why collective behaviour and conventional organisational theories have been distinct until recently is because few direct efforts have been made to reconcile the two approaches. Sociologists were seldom forced to study situations where both forms of behaviour were simultaneously present in the immediate situation. Sociologists looking at disaster situations could not avoid such situations; both kinds of behaviour abound in such crises.[1]

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[1] The suggestion to meld collective bheaviour with the actions of formal organisations should not be seen as a panacea to the problems associated with the study of social behaviour in disaster: Stallings suggests that "this comprehensive picture of human response to disaster...proved to be far from comprehensive" (Stallings 1978:88).

This general orientation (i.e. the focus on social interactions) has led to a number of researchers developing models of "disaster-time". Specifically, the models developed by Powell and Rayner (1952), Marks and Fritz (1954), Lang and Lang (1964), Beach (1967), and Turner (1976) will be discussed in a later section.

Sociologists doing research in the disaster area have been increasingly inclined to accept 'system' notions (Quarantelli and Dynes 1977:32). Researchers and theorists in disaster studies have also tended to see the system perspective as one avenue by which an interdisciplinary attack on disaster problems could be mounted. According to Rapaport, systems theory is

> "..best described not as a theory but rather as a program or a direction... . The outlook represented by this direction stems from various sources, and its adherents emphasise different aspects of the program".
>
> (1968:452)

Parsons describes social system as

> "The concept that refers both to a complex of interdependencies between parts, components and processes that involves discernible regularities of relationships, and to a similar type of interdependency between such a complex and its surrounding environment".
>
> (1968:458)

Sociological research on natural disasters has mainly been centred around a systems approach. Within this framework, most of the system approach is of the 'open-system' type in the sense that there is recognition of the interrelationships that exist between the basic components of the social system. (Basic components being such things as the family, religion, and law and order (social control) facilities).

The notion of systems suggests a way of circumventing disciplinary limitations, and allows interdisciplinary research and theory development. Thus in a statement by Miletti et al they asserted that

> "..the concept of system stress appears to offer a mechanism whereby research findings from studies of disaster might be integrated into a large body of literature across the social sciences."

Barton (1969) orientates himself to the task of trying to analyse the workings of social systems under stress, rather than reconstructing the psychic processes of individuals, collectively subjected to stress. He

> "employs the general idea in functional sociology that holds that the elements of a social system are not infinitely malleable but that change in each element is constrained by its interdependence with others in the system".
>
> (Merton 1969:XX)

Carr (1932) and Form and Nosow (1958) also developed models of disaster-time within a systematic framework.

3.2 Model Building

A good model of a system illustrates and provides a framework for comparing the real world. It also highlights significant features of the real world.

> "It purports to identify major elements of a system, to describe the strengths and directions of the linkages between those elements and to simulate dynamically the processes that underlie the elements and linkages. A good model serves also as a practical laboratory for social scientists in which the consequences of change in process can be explained for their practical import".
>
> (Kates 1971:442)

Most models, Kates suggests,

> "...fail to do either well. Lacking a theoretical understanding of process, the model-builder then resorts to 'black boxes'[1] frequently in the form of some probability distribution. A working model may ensue, even one useful for prediction, but unless one subscribes to the fiction that equates prediction with understanding, the model itself does not necessarily enhance the state of theory. Nor do most models succeed very well in their practical simulations... Nevertheless, we do learn from models, even in their failures and that is why we turn again and again to them in our research strategies. Faced with the need to model processes that we do not understand, we are given pause to determine whether we should seek to understand them before proceeding further. Then, when we resort to a 'black box', it may be because we have found that the process is not intrinsic to understanding the phenomenon directly under study".
>
> (Kates 1971:442)

The use of black-boxes does not explain the relationship between input and output, thus the researcher is still faced with the absence of crucial data. Having determined that there must be some reason for the different behaviour (output) due to a change in the environment that the person exists in (input), the researcher might be encouraged to try to obtain the links between the input and output with increased confidence, because he knows the inputs affected by the outputs. Thus we can emerge with what is most helpful for science: a statement not of gross ignorance, but of highly specific ignorance, a veritable agenda of research needs.

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[1] The inventor of the model may think of the human being as responding to certain stimuli (inputs) and as a result, portraying certain kinds of behaviour (output). To this extent he constructs a model of the human being and he asserts that the conceptualized human being has stated properties, these properties being relations between input and output. In this form his theorizing may be said to treat the individual as a 'black box'. That is, the theorist only reproduces the minimum relationship between input and output variables that combine to produce a given behaviour. This is regarded as a minimal model.

> "When we model a system, we reduce it to a mosaic, with distinguishable elements, boundaries and single characteristics which combine nevertheless to give a representation greater than the sum of its parts. To make it dynamic, we can animate the mosaic and if its representation is still recognizable, we have some reason to be encouraged".
>
> (Kates 1971:442)

Disasters and the more general human behaviour in extreme situations, are a type of event which can be described or measured along many different dimensions and in terms of many variables. In order to compare disasters, classify their variations and determine how constituent factors act and interact, it is necessary to formulate a general theoretical model which defines what these dimensions and factors are. It should be possible to describe under the categories of this model any disaster as a total event, leaving out no major dimension of social structure or process, individual or collective behaviour which can be observed. While it is obvious that no disaster (or event under any circumstances) can ever be completely described in this objective manner, there is a considerable difference between a description or illustration which leaves blank major areas of possible observation, or fails to organise what is observed into a coherent whole without internal contradictions, and one which is internally coherent and makes use of all available theoretical resources for the building of the observational frame of reference.

At present all we should expect from models in disaster research is a somewhat piecemeal development of general hypotheses and theoretical assumptions - miniaturized theories -

as Janis puts it (1954:16). This is so because it would be unrealistic to assume that theories pertaining to disaster phenomenon are somehow going to push far ahead of our present social science knowledge. Rather, we must expect the theoretical developments in disaster to grow directly out of the current theoretical concepts and hypotheses with which researchers in each of the various disciplines are preoccupied.

In Figure 9, an attempt is made to divide the effect of a natural disaster into different sectors for purposes of research. Different types of disasters will have different effects on social behaviour, primarily because each type of disaster (for example, earthquake compared to flood) has different boundaries or working areas. A flood is usually limited to riverine areas, flood plains or low-lying areas/ valley floors. It is a hazard when the floodwaters affect housing, work areas, including cultivated or grazing areas. The boundaries of an earthquake are more diverse. As well as affecting the areas mentioned above in the flood example, earthquakes can affect all areas of land, the limiting factor being the magnitude and the distance away from both the epi-centre and the hypocentre. Also, taking the example of the earthquake, each specific geophysical event has its own unique features; a Richter magnitude 6 earthquake is markedly different in effect from a Richter 7.5; and for that matter, two earth-quakes of the same magnitude will have different effects on the earth's surface depending on the depth of the hypocentre and the strata in which the earthquake is located.

It is not often that a hazard will have the same structure and consequence as another hazard. Therefore, the nature of the event has to be considered with respect to a disaster event. The extent of the hazard needs consideration also; whether it is localised (focalised: Carr 1932) or diffuse in physical area. The severity or magnitude (in the case of earthquakes) is important; the more severe the geophysical agent, the higher the probability of greater social, economic and physical disruption, together with psychological disruption.

The timing of the event is also important. The consequences of an earthquake, for example, on social and psychological variables, and the resulting numbers of casualties, death and social disruption depend to a high degree on whether the earthquake occurs during the working day or in the evenings and weekends. If it occurs in the night or in the evenings when most of the population are at home together as a family unit, anxiety is reduced for members of the family. Anxiety is heightened when primary groups are fragmented as is often the case during the working day. If it occurs during the working day at noon when there is increased concentration of people in certain areas of a city (such as the Central Business District [CBD] and outlying factories), the propensity for anxiety is greater. Because of the high concentration of people in the CBD during the business day and the relatively high density of buidlings, an earthquake could exact more injury and destruction than if the earthquake struck the CBD at night.

How long the disastrous event lasts, or the duration of the event is also a significant factor. An earthquake may last from seconds to minutes and tremors may occur before and after the main event that affect the community for months. A hurricane or a severe snowstorm may last for hours or days. A flood may present danger to a community for days or weeks.

Finally, the frequency of the event or a combination of different geophysical events is a deciding factor in understanding the consequences of a disaster. It needs to be noted here, that all these factors are dependent on the other variables in a disaster. It is the combination of these characteristics of the agent that causes a disaster (along of course, with the human use system). No one of these variables can be understood or can be performed in isolation.

Reactions to a disaster can be studied from different points of view. The reaction may be studied at a micro-level and concentrate on individual behaviour or, the study can concentrate on a group or other collective (e.g. family) responses. The study may concentrate its analysis on the reactions of organisations (formal/informal, emergent/established Dynes 1970); or it may be studied at a macro-level to include a study of the response of the affected community. Disaster analysis can also be extended to understand international or cross-cultural reactions.

These reactions from different social sections of the impact area are affected by other variables, such as whether the person, organisation or community has had previous experience with a disaster event (whether it be the same type of agent or of another hazardous agent). Has the individual or community got anything to 'fall back on' as a response to the abrupt change in the situation following impact? How does closeness of settlement affect reactions; will the reaction of a collectivity or group be the same in a rural area as it is in a large metropolitan city? Do reactions differ if the event is preceded by a prediction or warning? Are there measures within a particular organisation or community that indicates any level of preparedness for such an event; do societies have a defence organisation (such as the New Zealand Ministry of Civil Defence), established to help mitigate and co-ordinate action in a disaster? Which leads one to ask whether there is any established public policy in use to mitigate disasters, and what are the present adjustments in existence that can alleviate, deflect, absorb or buffer disaster effects? Also, what socio-economic mechanisms are available; what technological knowledge and capabilities are available to prevent disaster or to mitigate against the hazard? Do different cultural groups exhibit distinctive patterns of behaviour in times of crisis, as Wolfenstein suggests (1957).

Similarly, the consequences of a natural disaster may be sectorized to study such aspects as the economic consequences of disaster; what effect does an earthquake have on the insurance industry; what is the effect on the production and distribution of goods and services in the impact community with the onset of a particular hazard or series of hazards? Who is responsible for problems of equity and reimbursement relating to the consequences of a hazard? This leads to the question of legal and political considerations of the consequences of a disaster. Consequences may also be dealt with from a psychological perspective; what stress does such an event incur for the individual? On a community level, how does a community organise its members to cope and counteract a disastrous event; what effect does a natural disaster have on the existing social processes; are they sufficient to cope with a disaster?

Finally, disasters, if they occur frequently or if they are of extreme severity, are inclined to have a modifying effect on the community, although people, especially those in positions of power and influence, seem to be disinclined or oblivious to the reorganisation and the implementation of extra (costly) hazard-reducing measures. Apart from the obvious immediate response of restoration and rehabilitation, it is doubtful whether a community ever regains its exact pre-disaster situation. By a process of evaluation of existing adjustments, policies or technology may be revised, renewed, or created, thus more adjustments and new measures may be introduced. The scientific development of predicting hazards may modify future situations. In Seismology and other related geophysical sciences, researchers are trying to achieve methods of predicting earthquakes and to produce forewarnings of earthquakes (refer Evison 1977A, 1977b, 1977c). The occurrence of more earthquakes will advance the state of prediction; with each observed and monitored earthquake, there is an increased likelihood of more being known and understood about the processes and characteristics of earthquakes, thus gradually knowledge is built up to aid accurate prediction.

With each exposure to disaster, more and new experience is gained, both on an individual and on a collective basis through the process of internalization (for example, the internalization of a disaster subculture) or through the general process of mass education. This results in a change of effects or a reduction of the effect on the individual/ collective. The effect of geophysical events can also be physically reduced through the modification processes described above.

Figure 10 shows these same sections in another diagrammatic form, illustrating the interdependency of the sectors, showing how essential it is to integrate all the above (and more) features in order to gain an understanding on how natural disasters affect human behaviour. This diagram (Figure 10) does not purport to be an all-inclusive one; this is not the purpose of the creation of the schemata. What the schemata does try to illustrate is the complexity involved when a natural hazard agent strikes a community. The social scientist who is interested in disasters and the concommitant social disruption and organisation needs to consider these aspects and their interrelationships.

FIGURE 9: SCHEMATIC REPRESENTATION OF SUGGESTED AREAS OF RESEARCH INTO NATURAL DISASTER.

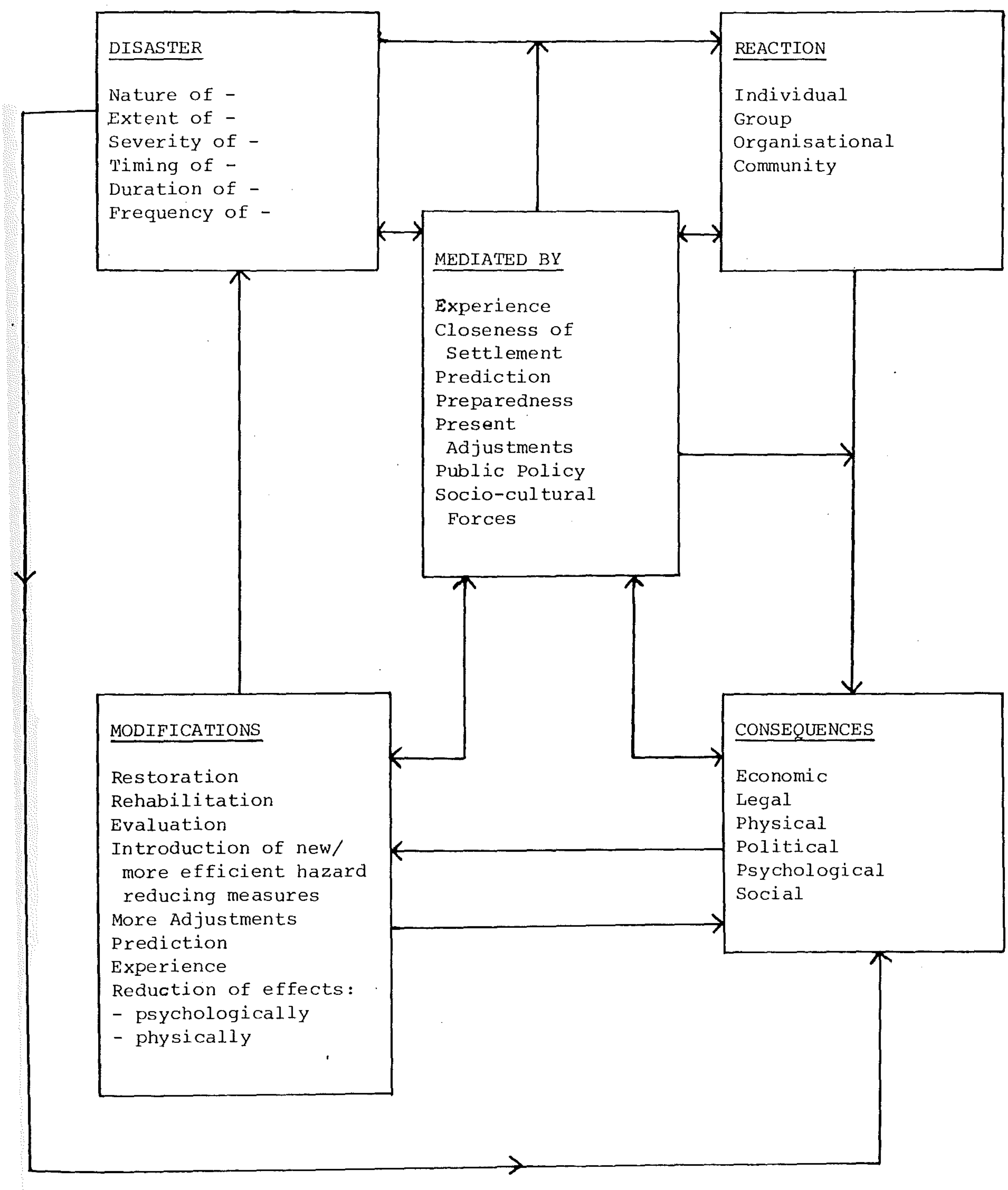
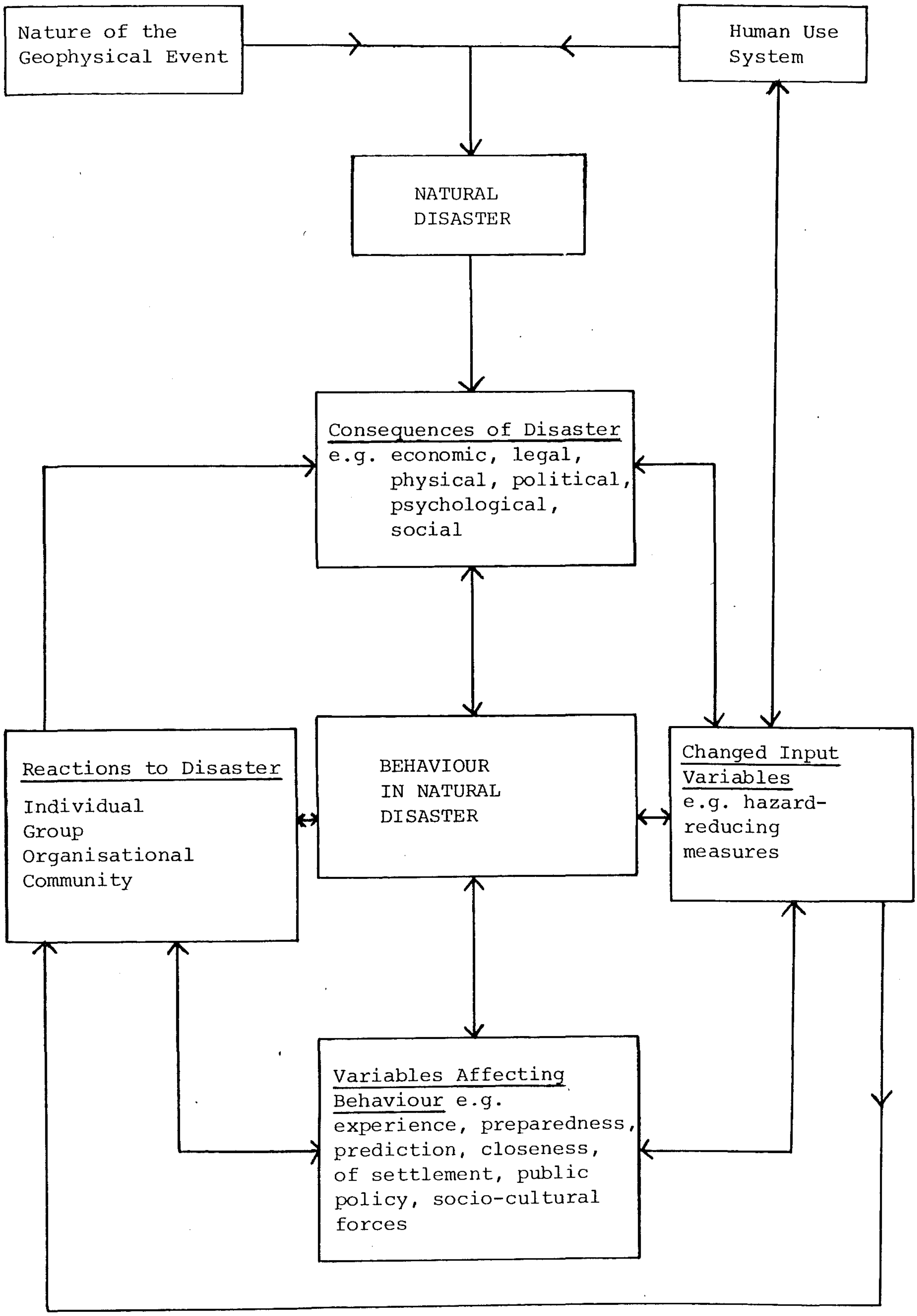


FIGURE 10: DIAGRAMATIC REPRESENTATION OF CAUSES AND CONSEQUENCES OF NATURAL DISASTERS.



3.3 Sociological Models of Disaster-Time and Disaster-Space

Although every natural disaster is a unique event - the type of geophysical agent, the timing, severity, duration, areal extent, and the frequency of events differ - one can generalise and comment on the overall dimensions of a natural disaster and the effect they have on the target community. That is, a comprehensive eclectic model can be used to explain the series of events that lead up to a disaster, the disaster period itself and the post-disaster phase. There have been several studies by various researchers to categorize the dimensions of a natural disaster, to itemize the consequences of events, both on a temporal and a spatial scale.

The present development of disaster time models does not have a fixed date, therefore any discussion would necessitate some arbitrary selection of dates of salient works and major contributions in this area. In 1932 Carr conceptualised disaster as a time sequence pattern of different stages, but little follow-up to this approach occurred until after World War II. Carr's model (1932) of a systematic study of natural disasters is as follows: In every disaster there is a preliminary period during which the forces which are to cause the ultimate collapse are getting under way. Carr calls this period the "preliminary or prodromal period" (1932:211). Of course, in some natural disasters these preliminary periods will remain undetected, thus societal members cannot prepare for all prodromal periods.

A second phase begins with the actual onset of the catastrophic forces. But not every windstorm, earth-tremor or rush of water is a catastrophe. A disaster is known by its works, that is, the disruption of the social processes and social structure such that the normal, everyday social life of a community is hindered. So long as a city resists the earth-shock, there is no disaster. It is the collapse of cultural protections that constitute the disaster. The deaths, injuries and other losses that follow this collapse are integral parts of the calamity. This phase is the "dislocation and disorganisation phase" (1932:211). The dislocation and disorganisation phase tends to pass into a third phase, the phase of "readjustment and reorganisation" (1932:212). From the time of the catastrophe until the emergency plans begin to operate is the time of the "confusion delay". This is a marked phase of every diffused disaster (i.e. a disaster that is spatially extensive) and is disruptive. This suggests an important difference between the diffused and focalized disaster: in diffused disaster the co-ordination of community life is one of vital cultural elements disrupted; in focalized disasters community co-ordination remains relatively unaffected, and the main problem, aside from the rescue, is to concentrate on the point of breakdown. Carr suggests that disasters should not be distinguished only on the basis of the consequences but also on the basis of:

1) the character of the precipitating event or catastrophe (type, frequency, spatial extent, etc.); and,
2) the scope of the resulting cultural collapse.

On this basis, there are at least four types of disasters:

(a) an instantaneous-diffused type: one which was over before one could do anything about it and wreaks its effect on the entire community (e.g. the earthquake in the Yugoslavian town of Kotor in 1979, which completely devastated the town and killed 200 people);

(b) an instantaneous-focalised type: one which wreaks havoc on a local specific area instantly, yet leaves the rest of the geographical/social area physically intact (e.g. the October 1966 Aberfan slag-heap disaster in Wales (refer Bolt et al. 1975: 183; Miller 1974).

(c) a progressive-diffused type: crises which last several hours to weeks which affect the whole community (e.g. the 1978 Southland floods, New Zealand); and,

(d) a progressive-focalised type: a disaster which lasts for a period of time but is localised (e.g. the sinking of the 'Titanic'). April 14-15,1912 (Carr,1932)

Carr's sequential approach became the groundwork for the extensive use of time models currently prevalent in disaster research.

Sorokin (1942) did some pioneer work on 'human calamity' but a theoretical model for scientific disaster studies is not available from him. Fritz used Carr's concept to investigate factors present in disasters. He later extended these into the following list of crucial factors which must be considered in a scientific analysis of the various types of catastrophic occurrences:

1) the speed of onset of the precipitating agent and the length of forewarning;
2) the nature of the destructive agent;
3) the physical scope and destructiveness of the disaster: and,
4) the length of the threat

Marks and Fritz have defined a disastrous event in systematic terms:

1) the event affects a community of persons, that is, a collection of people who occupy a common territory and are bound together in relatively permanent social relationships;
2) the event confronts a large segment of the community with actual danger or threat of danger and loss of cherished values and material objects;
3) the event results in deaths, injuries, the destruction of property and other losses and deprivations to the population (e.g. the disruption of community utilities and other community services);
4) the direct or indirect consequences of the disaster affect a large proportion of the population in the community (that is, the repercussions are diffused throughout the community compared to being focussed on a particular group or collection of individuals).

According to Marx and Fritz, if an event achieves these four characteristics, it can then be defined as a disaster (1954)(Note that these variables are not characteristic of natural disasters, but for disasters both man-made and natural).

Moore, using Carr's macro-distinctions, made further temporal distinctions, but without making them explicit temporal categories. Moore gathered catastrophe reports from his own tornado research and other sources and co-ordinated them into an ordered approach toward a theory of disaster (1956: but Stoddard suggests that although his studies fill a void in understanding the post-emergency phase over an estimated time period, it fails as a comprehensive, integrative tool for all types of disaster (Stoddard 1968:15).

Form and Nosow stated that there were three stages of a disaster that may be distinguished:

1. The pre-disaster stage, which highlights the normal functioning of the community before the impact of the disaster.

> "Too often the study of the pre-disaster stage has been concerned only with the preparation or lack of preparation for the disaster. However much may be gained by defining the pre-disaster stage as a normal period in which the community is functioning according to traditional expectations and values, and people are playing their traditional roles. This condition obtains whether or not the disaster is anticipated and whether or not preparations are being made for it. (Thus) the behaviour in disaster may be understood better if studied from the point of view of a functioning system that has become disrupted".
>
> (1958: 13-14)

Form and Nosow suggest that unless the pre-disaster phase is seen by researchers as an ordinary, normal and typical everyday functioning entity, then the researchers are not seeing the disaster and its consequences in the right frame of reference. For a disaster to be a disaster, one has to, as Kastenbaum stated (1974), regard the pre-disaster period/community as a normal functioning entity.

2. The emergency phase/stage which is the period when the serious disruption occurs. The activities and relationships that develop to meet the disruption may be referred to as a "disaster system". Ultimately the emergence of new social relationships is realised. These relationships contain certain elements of the pre-disaster organisation as well as new elements.

3. This is the post-disaster stage, which usually represents a new stable and enduring structure of community relations.

Lang and Lang presented a typology of disaster based on three dimensions. The first dimension refers to the distribution of effect. A disaster may be discriminating or undiscriminating in its effect. A discriminating disaster is one in which certain classes or groups are more vulnerable than others. For example, poor people have flimsier houses than wealthy people, who are more likely to live in well-designed houses. An earthquake will affect the structures of the poor people more than those of the rich (refer Davis 1978; Mitchell 1977:240; Taylor 1978). Thus there will be discriminating effects when an earthquake occurs in a stratified community. A bomb, on the other hand, will be undiscriminating in its immediate effect.

The second dimension distinguishes between anticipated and unanticipated disasters, depending on whether they were preceded by a warning period. The third dimension distinguishes between unprecedented and recurring disasters, depending on whether similar disasters have struck a particular population before and have left traces in the social organisation. Lang and Lang have developed a psychological concept, "morale", to account for the relationship with which they are most concerned; the effect of impact on behaviour. They define morale as "continued performance and co-ordination of roles in situations of stress" (in Brown and Goldin 1973:57). In terms of their causal scheme, in which morale mediates between impact and effect, the typology of disaster proposed by Lang and Lang allows them to say that undiscriminating, unanticipated, unprecedented disasters will probably pose the greatest threat to morale. As such, it will result in the greatest amount of social disorganisation. But discriminating, anticipated and unprecedented disasters, given adequate resources, will generally lead to well-organised and highly functional behaviour.

Most contemporary evidence however is

> "...directly opposed to the portrait put forward by Lang and Lang of disorganised, chaotic and atomized populations in situations of undiscriminating, unanticipated and unprecedented disasters".
>
> (Brown and Goldin 1973:58)

The chaos Lang and Lang postulate would only occur if there was no basis for the local integration of the population. It would have to assume that people are social and orderly only in reference to the most abstract and inclusive system of which they are members. Lang and Lang's causal model does not allow for the most important features of disaster that have been observed, such as altruism, cooperation, inter-group conflict.

Beach, in his paper distinguishes five major time phases.

> "The reaction of people in the different zones of disaster space is a function of the particular time phases in which they happen to be observed".
>
> (1967:18)

The first phase, the Pre-Disaster Phase, is really the period before the disaster. It is included in the scheme because of its importance in determining the effect and response to the disaster.

> "The pre-disaster conditions include such factors as the nature of the buildings in the area, the availability of shelter and communication facilities; the population's previous experience with disasters, and the availability of organised and trained personnel with appropriate resources".
>
> (Beach 1967:18)

Additional factors include such things as the time of day the event occurs and the chance presence of special services (e.g. the presence of the Armed Services). With such services present on the scene, Beach postulates that the disaster-stricken community has a quicker chance of recovery.[1] An example of

[1] In the case of the Armed Services being present, in or near an impact area, the command structure within the Armed Services organisation can augment and accelerate the recovery of a community because military organisations have established chains of command and divisions of labour that enable these organisations to co-ordinate and control the activities of large forces of men. This ability to co-ordinate and control large forces of men means that the Armed Services can mobilise very quickly, organised and disciplined personnel into a disaster area who can carry out rescue, relief and remedial activities at a level much greater than the 'civilian' impact population.

this particular service can be illustrated in the 1964 Alaska earthquake and the presence of the Armed Services stationed nearby (refer Anderson 1969)[1].

The second phase is the Warning Phase. This covers the period from the first appearance of possible danger signs to the moment of impact. It may be sub-divided into early warning, or an Alert Phase and a late warning or Threat Phase. The Alert Phase typically involves

> "...vague and ambiguous signs and partial information indicating the possibility of a disastrous event at some time and some place".
>
> (Beach 1967:19)

Warnings may turn out to be true or false. They may be noticed by a small or large proportion of the population and they may be taken seriously or ignored. The late warning or Threat Period involves cues and information which is not ambiguous, at least to most people. This Phase is usually short and is followed by impact or by awareness that the danger has passed. Threat cues are typically an urgent indication for immediate protective and survival action. Also the threat is usually localised as far as disaster space is concerned.

The Impact Phase is the period in which the disaster agent causes death, injury and destruction. The force of the destructive agent is usually confined to a particular area.

> "Impact may last for only a few seconds or minutes or may be prolonged as in the case of floods or snow/wind storms".
>
> (Beach 1967:19)

The Emergency Phase begins at the end of impact and continues to the time when the dead have been removed, the

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[1] The presence of the Navy was also instrumental in rescue and relief work in the 1931 Hawkes Bay earthquake.

injured cared for, secondary threats (fires, hot wires etc.) have all been dealt with, and survivors temporarily cared for. The emergency period may be divided into two parts: the Isolation Phase and the Assistance Phase. The Isolation Phase is the period during which the survivors are on their own. It lasts until organised and professional assistance comes from outside the impact zone, marking the beginning of the Assistance Phase. The Isolation Phase may be prolonged by one or more of several conditions. First, the outside world may lack information about the location and conditions of the survivors. Second, access to the impact zone may be hazardous and extremely difficult. Thirdly, communities adjacent to the impact zone may be ill-prepared to offer emergency assistance. Finally, a situation may arise in which potential helpers from adjacent areas may fear to enter the impact zone because of continued danger (for example, after shocks from earthquakes; swollen rivers from floods; lava flows from volcanoes).

The Recovery Phase

> "...begins approximately when the emergency tasks of search, first aid and emergency health and welfare cases have been provided with temporary shelter, food and facilities. At this point, emergency agencies typically turn their authority over to the local officials".
>
> (Beach 1967:20)

The primary tasks of the recovery period are relief, relocation, reconstruction and general rehabilitation. Beach states that it is difficult to determine the end of the Recovery Period. Probably the community that has been devastated by a disaster will never be quite the same again. However, when the social and economic system is back to its pre-disaster level of functioning, Beach assumes that Recovery is said to be complete in the sense that the effect of the disaster has ceased to have repercussions on the remainder of society.

Barton refers to a five-phase typology of disaster time, but he states that the labelling of such phases is only a quantitative step toward more precise methods in analysing change in a system of variables (1969:49). This classification, like the studies Barton used as a base, is oriented mainly to the situation of a community disaster in which individuals, small groups and organisations are participants and to which the undamaged regional or national system provides help. Barton's five phases are:

1) the pre-disaster period;
2) the period of detection and communication of warning of a specific threat (which is absent or truncated in sudden disasters);
3) the period of immediate, relatively unorganised response (which is a very important phase in sudden disasters, but less so in the gradual or long-term impact);
4) the period of organised social response (which may cover days or weeks of lesser intensity and scope, and may require years in the case of very heavy impacts or long-continuing stresses);

5) the long-run post-disaster equilibrium when the system has completed such reconstruction as it can achieve and has incorporated the 'permanent' effect of the disaster (this long-run situation may or may not represent a restoration of the status quo).

Many of the contributors to disaster literature have set out developmental sequences relating to disasters, but because of the emphasis upon problems of rescue and recovery, and possibly too, as Kastenbaum has stated (1974), because disaster researchers are preoccupied with the "bolt from the blue" hypothesis about disasters, these sequences virtually without exception, according to Turner (1976), start from the onset of a disaster, treating any prior events in a cursory manner, if at all (Turner 1976:753). Typically, such consequences begin with a warning of danger and move through the onset of danger to the problems of alarm, panic, and rescue (1976:753). Consequently, none of these sequences is particularly useful in gaining an understanding of the events which lead to the disaster, nor are they helpful in enabling the researcher to identify specific features of the pre-disaster phases which might make such phases recognizable to the occurrence of disasters. Turner's model lays equal emphasis on the pre-disaster context and the post-impact period:

Stage 1: Notionally normal starting points

a) initial culturally accepted beliefs about the world and its hazards.

b) associated precautionary norms set out in laws, codes of practice, mores and folkways.

Stage 2: Incubation Period - The accumulation of an unnoticed set of events which are at odds with the accepted beliefs about hazards and the norms of their avoidance.

Stage 3: Precipitating Event - Forces itself to the attention and transforms general perceptions of Stage 2.

Stage 4: Onset - The immediate consequences of the collapse of cultural precautions become apparent.

Stage 5: Rescue and Salvage - first stage adjustment. The immediate post-collapse situation is recognised in ad hoc adjustments which permit the work of rescue and salvage to be started.

Stage 6: Full Cultural Readjustment - An inquiry or assessment is carried out and beliefs and precautionary norms are adjusted to fit the newly gained understanding of the world.

Turner's model cannot however be applied to such natural disasters as earthquakes because it disregards those disasters that 'spring into existence' immediately and in a fully developed condition. By drawing attention to the 'Incubation Period' this model is more appropriate to those disaster situations which have a recognisable build-up period (for example, hurricanes, cyclones and floods (not though flash floods). Since most disasters are unpredictable (Drabek 1970), it may be unrealistic to claim that an incubation period, as described by Turner, is an integral part of the disaster analysis of analysis in all disasters.

Before the Disaster-time model that has been used in the study of the 1968 Inangahua Earthquake is considered (i.e. Powell and Rayner's (1952) model), it might be useful to turn attention to the spatial aspects of disaster. Wallace (1956a) provides a model (Figure 11) of disaster-space. The disaster space has been divided into five zones depicted by concentric circles (it must be remembered that this is a highly schematic portrayal of disaster space; for instance, in a tornado, the path of the wind-tunnel may sweep across a section of the community, leaving areas on each side of its path relatively unscathed. Hence the disaster space in this example would not be concentric). This schematic representation may also be too generalised for earthquakes; the underlying geomorphological conditions may in effect allow the shock to be absorbed in some areas and thus suffer little damage, whilst other areas equi-distant from the epicentre may have greater damage.

Central in Wallace's diagram is the area of Total Impact, not total destruction, but the area that received the full fury of the disaster agent. However, there is usually much more destruction in this area compared to adjacent areas. Moreover, the area of impact is usually fairly clear to the victims as well as the outside helpers and onlookers. The second, or Fringe Impact is closely adjacent to the area of total impact, and is distinguishable in that it has usually suffered only minor damage and few, if any, casualties. Some people in the fringe area may also think that they have been in the centre of impact at least for a short time.

> "Their first reactions following impact is usually to check their families, after which they may investigate the impact area and begin rescue work. If the impact area is a continuing source of danger (e.g. fire or flooding) they may evacuate their families".
>
> (Beach 1967:18)

The third, or Filter Area is the next adjacent area which has suffered no damage or casualties. It is typically a source of help and services, "as well as the area through which traffic and information pass back and forth from the impact area to the outside world" (Wallace 1956b:5). This presumably, is also the case with the fringe impact area, but not as intensively, because the fringe area will have suffered some damage, while the filter area has not. People in the filter area will usually be aware that disaster has occurred and have a fair idea of its location. As the name suggests, the filter area is permeable to some inputs and outputs but not to others, (for example, roadblocks set up to enable emergency services to pass through and keep onlookers out). There is also a convergence of messages from the outside world so that almost every disaster involves an overloading of whatever channel may be operating. Requests for information, attempts to reach family or friends, offers of assistance and so forth flow into the stricken area and require filtering.

FIGURE 11 : GRAPHIC ILLUSTRATION OF ZONES INVOLVED IN DISASTER

Source: Beach H.D. *et al* in MANAGEMENT OF HUMAN BEHAVIOUR IN DISASTER (EMERGENCY HEALTH SERVICES) 1967:17

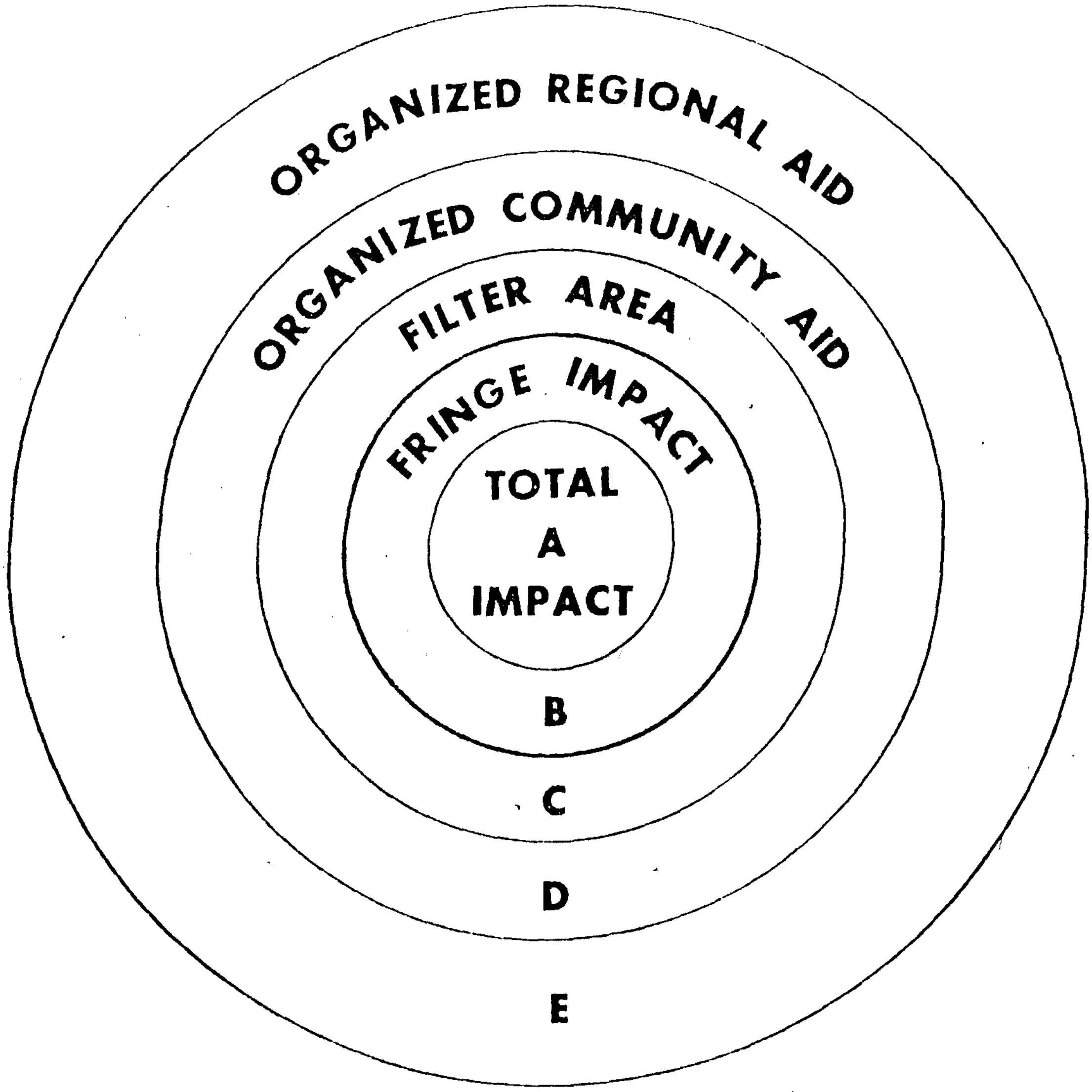

Figure .Graphic illustration of zones involved in disaster. (Adapted from Wallace, 1956)

The fourth and fifth areas, or Organised Community Aid Areas and Organised Regional Aid Areas are not directly affected by the disaster socially in the sense that this area is not affected by family disruption or confusion and disorganization (although economically it is assumed that every region will be affected in some way, even if it is only in the relocation of resources and money to the impact area). These areas are the primary source of organised emergency personnel and services "in the form of police and fire departments, medical and hospital services and relief agencies" (Wallace 1956b:5). At the time of impact, the community and regional areas may be largely unaware that a disaster has occurred and are seldom aware of its precise location. There is typically a time lag before they receive the relevant information which will enable them to mobilize their resources and move in to provide emergency services.

Wallace suggests that in any disaster the above categories of spatial dimensions can be mapped and distinguished by the various behaviours of the occupants and the physical effects of the disaster agent with respect to the disaster event.

3.4 The Powell and Rayner Model of Disaster Time

Powell and Rayner in 1952 proposed a descriptive scheme for a disaster, based on a formulation in terms of development stages. They characterised each stage by its own integrative mechanism, distinctive variables and a set of unique tasks for each of the various actions of the affected social system.

Compared to Carr's (1932) typology, Powell and Rayner's scheme exposed a number of different processes by which an occurrence is defined and takes shape as an occasion for social action. Form and Nosow's (1958) model is related entirely to the functional perspective and regards the situation as a functioning system that has become disrupted due to the input of a disaster agent. It is, therefore, restricted in its application mainly because it does not acknowledge the activities, interactions and meaning of the situation by members that become apparent in a disaster situation. Form and Nosow's typology is reminiscent of an organic analogy of society and tends to view the disaster agent as a pathological condition which the 'system' will rid itself of with a restructuring of the social structure (refer Rubington and Weinberg 1977:19). Lang and Lang (1964), on the other hand, have developed a typology of disaster behaviour from a psychological perspective. The underlying assumptions inherent in this model though have been questioned and opposed, thus reducing the validity of the model (refer Brown and Goldin 1973). Besides this opposition, however, Lang and Lang's model is narrow in its focus, and does not explain collective behaviour, being concerned only with individual, psychological behaviour. As such, this typology is devoid of utility for an extensive elaboration of the periods of a disaster siatuion.

Beach (1967) and Barton's (1969) models are based on the format developed by the Powell and Rayner model (1952), as will be seen below. Barton's emphasis is placed on the social system and its ability to organise its constituent parts and to function in an appropriate manner to lessen the effect of the disaster agent. It is orientated towards a macro-sociological perspective and views the disaster situation as it affects the mechanisms of the social system. Beach's model places less emphasis, compared to Powell and Rayner's model, on the inter-relationships of the disaster-victims within the impact area, and less emphasis on the phenomenology of the disaster situation, with more attention and stress placed on the disaster as a social process.

Turner's (1976) model also places emphasis on the disaster as a social process. No stress is placed in this model on the phenomenology of the disaster-event (although the meaning of the disaster is seen in terms of cultural mores, folkways and beliefs; the emphasis is on the cultural indoctrination of disasters as a social phenomenon). Turner describes the process of a disaster event in terms of the re-appraisal of cultural beliefs previously internalized within the social members; beliefs which they now find inappropriate.

Powell and Rayner's analysis allows the conclusion, according to Brown and Goldin,

> "...that many of the phenomena associated with a disaster can only be understood in terms of their meanings for the affected collectivities".
>
> (1973:60)

Powell and Rayner's typology is, according to Brown and Goldin, a phenomenological view of disaster (1973:66).

This phenomenology of disaster can be usefully systematized by reference to typical periods of time within the course of a disaster since these periods are presumably related to types and problems of behaviour. Powell and Rayner proposed the division of disaster into seven phases, preceded by a Pre-warning phase:

1) Pre-Warning Phase

While not technically a 'stage' of disaster, the prior cultural conditioning of a disaster population has to be taken into full account in studying or evaluating given responses, or in predicting major patterns of behaviour under anticipated stress. This includes all the conditioning, internalization and socialization which form the cultural matrix into which the disaster strikes. Major factors are the knowledge and folklore about the given threat/agent, its sources and consequences and the familiarity and attitudes towards the disaster agent. Such preconditioning also includes culture-borne group traits such as stoicism or extreme emotionalism, cooperativeness or rebelliousness, cohesiveness or disorganisation[1], and religious values or cultural values-systems involving, for example, attitudes towards authority and towards death. Finally, preconditioning must include the growth of the personality structure which dictates the response of the individual to disaster stress; the development of the personality pattern within each involved individual is part of this cultural preconditioning. The

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[1] refer M. Wolfenstein, Disaster: A Psychological Essay (1957), for a full discussion of the traits of various cultural groups. See also Britton 1979:29-30.

Pre-Warning phase is suggestive of what Kastenbaum calls a 'period of non-disaster' (1974:66), that is, a situation in which the social system is in a state of (relative) environmental equilibrium. Without periods of stability or non-disaster, which in effect highlight a disaster period (because the disaster period is then regarded as atypical or an abnormal social condition), the disaster period would become the normal situation.

2) Warning Period

At this stage there arises some apprehension based on conditions out of which danger may arise. This apprehension may not necessarily be based on empirical evidence. Precipitate disaster, like those involving sudden explosions and (at present) earthquakes, may not be preceded by any period in which the victims are aware of mounting danger. But in disasters whose slower approach gives cues and opportunities for public apprehension (for example, a mounting flood or a cyclone/tornado), the period of warning is one in which, because of the fragmentary and ambiguous signs of danger, minor changes in the stimulus situation can in turn alter or reinforce interpretations of what little information there is available, (Chapman 1962:10)

> "It is clear as a practical matter that the prevailing situation in the period of warning is that of human search for certainty in the absence of reliable information. Whenever officials have failed to structure this period as soon as possible by explicit warnings and relevant information, the studies of disaster have found the consequences are public confusion and over-anxious behaviour".
>
> (Chapman 1962:10)

This behaviour seems a natural consequence of a period of warning. Alternatively, it is a situation in which no one will take any notice, thus social life will remain as it was before the warning phase. The warning phase itself is usually one which is produced by those in positions of authority; it is usually through some official channel that warnings are issued. This is because the warning phase carries with it a period of inactivity on the part of the phenomenon; it has not yet manifested itself, or it has not yet imposed itself on the community. When it does it becomes a threat.

3) Period of Threat

People are exposed now to communications from others, or to signs from the approaching disaster-force itself indicating specific imminent danger. In this phase of approaching danger, human beings face more urgently the same problems of resolving perceptual ambiguity that were experienced the "Warning Phase". Threat usually involves what Shibutani (1961) referred to as improvised processes of communication or rumour as people receive and share news of the impending occurrence. As a result, the organisation of social action at this stage of disaster is largely decentralised and interpersonal; that is, a threat is seen as something affecting everybody, not just the single person; a contrast to how people regard the disaster after impact.

Some theorizing, although not much empirical research, has approached the decision-making of individuals in the period of warning and threat as a problem in game theory (Chapman 1962:11). It is plausible, according to Chapman, to think that personal decisions about what to do in the face of danger take place within a complex of implicit personal estimates:

1) how likely the threatening even is to occur and how soon;
2) how great a loss the person will suffer if it does and if no countermeasures are taken;
3) what measures of protection are open to him;
4) how effective each measure will be;
5) the cost of such measures in money, effort, anxiety and other deprivations.

A change in any of these estimates should be reflected in what the individual will do in response to the warning and how quickly he will react.

4) Period of Impact

It is during this phase that the disaster agent strikes with concommitant death and/or injury and destruction. During the period of impact, the disaster situation is acknowledged and defined. The boundaries of the affected social system are established as are material limitations on collective and institutional behaviour, the status of individuals and groups in relation to disaster and the priorities of official agencies concerned with rescue and recovery. It may be noted that the period of impact is not the period of maximum destruction of normal modes of behaviour. In fact,

> "...all stages of disaster listed by Powell and Rayner involve action that is strikingly different from that found in other social institutions. What is unique about each stage is the mode of social organisation it implies rather than the degree to which behaviour is or is not socially organised".
>
> (Brown and Goldin 1973:63)

Research has furnished several important descriptive generalizations about the behaviour of people at the moment of actual impact from natural disasters, and some of these generalizations differ sharply from the pictures often given in fictional and journalistic accounts (see for example Noll 1976; Fritz 1961). The folklore of cataclysm frequently asserts that panic, in the sense of wild terror-stricken behaviour, is natural and commonplace in a natural disaster. But quite to the contrary, panic has seldom been found in the study of actual disaster (Smelser 1963:136). The accumulated mass of interview data from survivors concerning what they themselves did during acute danger, and what they saw others doing shows that behaviour under the impact of natural disaster is surprisingly rational, courageous and calm. Panic behaviour has consequently come to be recognized as an exceptional phenomenon arising under exceptional conditions.[1]

Despite its heuristic, educational value, the term 'impact' is ambiguous. A tornado sweeps across a region, severe earthquakes may be followed by fires. It is generally impossible to determine the period of maximum destruction except in retrospect. The ambiguity of the term lies in the failure to specify the perspective, including the values and principles of assessment from which a period of impact is determined.

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[1] For a good description of panic behaviour, refer Smelser, N. 1963, pp. 131-138; and Wolfenstein 1957, Chapter II.

5) Period of Inventory

In this period, those exposed to the disaster begin to form a preliminary picture of what has happened and of their own condition. Following the impact with its numerous problems of definition and description, the inventory stage is more clearly defined. This is the period in which official and unofficial social units establish rules of action based on the boundaries, the social divisions and the priorities established by the impact. According to Brown and Goldin, the period of inventory is the mature stage of a political process. The jurisdictions claimed by social units and the relationships among them begin to appear as matters for negotiation. The rules of action and the situations to which they apply delineate a new order at the local and superordinate levels of a community (1973:63).

Stock-taking begins after the strike of a disaster, with the efforts of the stunned individual survivors to come to an understanding of the catastrophe that has just taken place. The evidence shows that an immediate effect of the impact is to produce a momentary fragmentation of the social scene into isolated individuals, each overwhelmed by the event and each believing for the moment that he and only his immediate companions have been the victims. As the survivor struggles for a comprehension of his condition, he comes rapidly to some realisation of the mass destruction that has taken place. As the survivor begins to find that there are others who also felt and survived, these feelings give rise to a powerful sense of gratitude at still being alive, and of concern and warmth for other survivors.

It has been pointed out that the apparent confusion of activity that the unpracticed observer sees immediately after disasters is not aimless for most of the persons involved in it. Individually they are acting in highly purposeful directions. It is only because their activities are not socially coordinated at first that the appearance of random confusion arises. It follows that the first acts of rescue by survivors are often heroic, typically rational and sometimes successful - but also relatively unorganised and inefficient.

6) Period of Rescue

Activity now turns to immediate help for survivors, first aid for the wounded, freeing trapped victims, fighting fires and the like. The phase of rescue is divided from that of the preceding impact by "naturally indistinct boundaries" (Chapman 1962:17). Most people in the impact area of a forceful disaster agent are momentarily stunned. But most of them soon recover mobility and, as they start to assess their situation and take steps to cope with it, the rescue phase may be said to begin. Although rapid recovery from the immediate shock of impact is the rule, a number of survivors manifest what has come to be known as the "disaster syndrome" (Wallace 1956b:109-66). They do not quickly emerge from the stunned conditions but continue to act in a dazed way, withdrawn and relatively immobile; or if they do move about, they do so in an aimless, abstracted manner.

7) Period of Remedy

More deliberate and formal activities are undertaken toward relieving the stricken and their community both by survivors and outside relief agencies that have now moved into the scene. Now the community begins to reorganise. Specialists take charge in their spheres of competence and Government officials resume their authority. Chapman states that

> "...the flowing in of relief to a disaster-stricken community is the beginning of that healing period in which the community moves to planful and longer term measures of recuperation. In some cases such a process may presumably last for years, particularly if one includes in it such slow recovery as the building of obliterated areas or individual adjustment to the death of a relative or friend".
>
> (1962:19)

During the stage of remedy, efforts are made to deal with the effect of disaster beyond the immediate requirements of the victims. This stage involves attempts to reconstruct basic social and material conditions of life along predisaster lines. The success of these efforts depends to a great extent on the co-ordination of the official and unofficial practices because by this time, as mentioned earlier, both types of organisation will probably be working in the area.

8) Period of Recovery

For an extended period, the community and the individuals in it recover their former stability. The priorities for officially instituted change reflect political as well as other considerations, such as economic policies and new priorities which may explain why disaster rarely leads to significant changes in a social order. We do not know much about the long-term changes that may be brought by disaster because, according to Powell and Rayner, almost no research has been undertaken to follow a stricken community.[1]

Powell and Rayner's disaster-time periods have been found to evoke typical behaviour, and their usefulness as a basis for suggesting research has been great enough to have brought about this time scheme and others that are based on the Powell and Rayner typology (refer Beach 1967, Barton 1969, Wallace 1956).

Powell and Rayner's periods of disaster-time were used as a framework to study the effects and results of the 1968 earthquake that occurred 15 kilometres north of the South Island township of Inangahua, New Zealand. The following study is the result of an analysis of the earthquake and its effects on the townfolk and the social networks within that town, the research based on the model devised by Powell and Rayner in 1952.

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[1] Up to the present, this situation has not changed significantly. There are studies that have focussed on the post-disaster period, especially for example Haas <u>et al</u> (1977). Generally however, this area of disaster research remains relatively untouched.

CHAPTER IV

METHODOLOGY IN DISASTER RESEARCH

4.1 General

A disaster is almost by definition a trigger for alterations of the social landscape. Because disasters are often succeeded by spectacular social transformations, they are of considerable methodological importance, for here certain social processes, unnoticed in more normal circumstances, appear in exaggerated or highly accelerated forms (Dynes 1976:7; Killian 1956; Shader and Schwartz 1968:99). Strictly speaking, we cannot talk of the methods of disaster research for there are no special methods unique to this field. Its methods are the methods of social research, the available techniques are those of social research, the essential logic is that of social research. Interviews, observations, surveys, questionnaires, use of documents, sampling and experimental laboratory techniques are all methods that can be used by the researcher to study the social effects of disaster. Conducting research on communities just struck by a disaster confronts one with special problems. Since most disasters are unpredictable, one never knows where or when the next research opportunity will appear. Failure to begin data collection immediately may reduce its validity. Rarely is pre-impact data available, a necessary prerequisite for the observation of change induced by a disaster and a necessary ingredient to recording the full impact of the disaster-agent on the community. Local co-operation may be adequate at the outset, but as more outsiders arrive with insurance, sales, welfare, news media reporters and other types of enquiries, research interviewers can become increasingly suspect in the eyes of the victims, and can become a 'nuisance' for the authorities who are attempting to control and organise activities to mitigate the impact of the disaster. For these and other numerous reasons, Drabek states that most disaster research has lacked much methodological sophistication (1970:331). In general, the validity of the conclusions drawn from any research rests upon the scientific adequacy of the methods by which the data are collected and analysed. But, as Killian states:

> "The use of standard, proven methods does not in itself guarantee the production of valid, significant results. Much social science has been done which is methodologically impeccable but theoretically and pragmatically insignificant because methods have been used mechanically and indiscriminately. Whatever the subject, methods should be carefully selected and skilfully adapted to meet the requirements of the particular area of research".
>
> (1956:1)

Killian has said,

> "There is no area of social research in which the scientist must operate with less freedom than in the field of disaster study. Controlled experiments, except in small-scale, simulated models, are forbidden the investigator. Since disasters are highly unpredictable, he rarely has the opportunity to select the locus of his study before the disaster has occurred".
>
> (1956:4)

Usually the locus is determined for him by the unpredictable forces that produce disasters. Cases must be selected on the basis of the few variables that can be controlled, not in terms of the wide range of variables that it might be desirable to control. Indeed Killian states that "insistence on a large number of variables may lead to no research at all (1956:4). Killian is not advocating less rigorous models when the application of those models are oriented towards disaster research; he is pointing out that the lack of knowledge as to the time, place, and nature of the disaster means that "a specific research must be crystalized hastily, with a limited knowledge of the situation" (1956:5; Cisin and Clark 1962:25).

Critical factors determining what actually happens when a given impact strikes a community are likely to include elements of geography, culture, demography, ecology and particularly social relationships and personalities which have their origin considerably further back in time than the week or two preceding the impact itself (Wallace 1956a:24). For a better overall understanding of the community in the disaster situation,a historical concept is beneficial so that the researcher can put the behaviour induced by disasters in context by comparing the new social system to the normal pre-disaster scene. Basically, the methodological problems of field studies in disaster are those common to any effort to conduct scientifically valid field studies in the behavioural sciences. The disaster situation itself, however, creates special or aggravated problems for field studies.

The initial entry into disaster research must be a set of <u>descriptive</u> studies, detailing the behaviour with which disaster research is concerned. Descriptive studies tend to be informal observational studies that attempt to answer the question: "Just what exactly happened?" Since, in any disaster, a great many things happen, it is perhaps inevitable that any descriptive studies characteristically reflect the selective perception of the observer. The newspaper reporters see one thing, the psychologist sees another, the sociologist still another. The descriptive studies serve the principal scientific purpose of introducing the researcher into an unfamiliar area and of steeping him in the phenomena to be studied more formally in the future.

> "The principal purpose of descriptive studies is the generation of hypotheses, the encouragement of insights and the beginnings of explanations".
>
> (Cisin and Clark 1962:38)

Descriptive studies, particularly those employing formal survey methods, and structured interview techniques, tend to develop into analytic studies; studies reporting relationships between disaster behaviour as a dependent variable and other characteristics of the individual, family, community as independent variables. To accomplish the purpose of reporting correlation coefficients, differential probabilities or distribution of proportions of people who behaved differently during a disaster, these analytic studies must forego the artistic insight-making of the descriptive studies and adopt more formal methods so as to ensure, for example, that every respondent is asked for information on the characteristic to be reported in relation to the disaster behaviour. Similarly, for dependent variables, the forms of disaster behaviour must be standardized so that relationships may be shown unequivocably. In planning such studies employing sampling survey methods and structured interview techniques, the researcher is obligated to decide in advance what items will be placed in the questionnaire, and is restricted to those items throughout his analysis. This restriction is the price paid for taking the next step toward hypothesis generation beyond that which one is able to accomplish in descriptive studies. The results of the analytic studies must be regarded as hypotheses rather than conclusions.

> "At best an analytic study can be said to test hypotheses of relationship rather than hypotheses of explanation or causation. But without going through this step of observing relationships, it is extremely unlikely that an explanatory model can be constructed and explanatory hypotheses tested.
>
> (Cisin and Clark 1962:40)

Research planning takes time, and as Killian points out (1956) time is what the researcher has least of in many disaster studies. Difficulty piles on difficulty at each step of the research, and the researcher often finds himself incapable of applying the rules he knows so well.[1]

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[1] Refer, Bell, C. and Newby, H., Doing Sociological Research, (Allen and Unwin, London) 1977:10, for a discussion of the problems of normative and actual methodology in research.

> "The carefully defined population that he would like to study is thoroughly disrupted; his sampling plan may be no more than a nonrandom selection of the personnel he can locate; his data-collection procedures suffer from transportation and communication troubles. In short, improvisation has replaced method, and the quality of the results seem to depend on the researchers ingenuity rather than upon his scientific skill".
>
> (Cisin and Clark 1962:23)

Perhaps the greatest problem in disaster research stems from the lack of time for careful investigation of the particular situation prior to data collection in the field. This leaves the investigator with no choice but to work out a basic design for the disaster. Killian examines this question of determining whether the 'available' disaster will permit the application of the prepared design and recommends that the investigator keep not one, but several suitable, flexible designs in readiness. Then,

> "...if he has a more general model and set of hypotheses about the effects of different kinds of warnings...he can go into a wide variety of disasters and test some of his hypotheses".
>
> (Killian 1956:13)

A preliminary reconnaissance of the disaster situation should always be made. This reconnaissance may be made by members of the research staff who can reach the scene quickly. News reports, particularly early bulletins, cannot be relied upon, for often they provide an incomplete, distorted picture of the situation. Hence, they should be supplemented by interviews with a few key personnel who are believed to be in a position of authority, even if they provide incomplete information; these should be augmented with interviews and the observations of the victims themselves. To gather as complete information as possible, Killian also suggests that personnel to be interviewed should come from different levels of the hierarchy of the same organisation, as well as from different organisations, and a cross-section of the community should be attempted.

No matter how 'open-ended' his research design and his data collection procedure, the investigator will be selective to some extent and he must have some general assumptions or hypotheses to guide him in the search for new variables and relationships. These should be explicitly stated, both to protect the investigator against his own biases and preconceptions, and to guide him in the search for significant data.

> "The procedures for analysing disaster field-study data are the ones a competent investigator would normally select to suit the research design and the data collected".
>
> (Killian 1956:32)

This is not a special problem. A few of the customary problems tend to become exaggerated in the analysis of disaster studies however.

> "The first point is to urge the investigator to give very careful consideration to situational variables and matters of context in building a code or other analytical scheme...An analysis of the perceptions, motivations and actions of such subjects may be quite misleading if the code does not account for the possibility that some actions or some sources of information were physically unavailable to the actor".
>
> (Killian 1956:32)

The investigator will probably be unable to include all of the factors of situation, context and background in his code and keep it manageable, but he should make as certain as he can that he has included relevant variables to the particular hypothesis and relationships he wishes to analyse.

4.2 Techniques of Obtaining Data

1) Interviews

The method which has been most widely used in disaster field-studies is the personal interview. Some researchers suggest that interviews must be used in such circumstances. Baker says,

> "In order to gather factual information, attitudes and opinions in communities... interviews should be administered".
>
> (1964:325)

And, according to Baker, interviews should be administered:

a) during the period when there should be an awareness that an impending threat could occur (for example, in the case of tornado and hurricane-affected areas, interviews should be conducted approximately six months before the season normally begins. When earthquake prediction becomes a reality, interviews should be conducted when the prediction is publicised (refer Turner et al, 1979 as an example of interview data on the 'California Bulge'). This is the time when individual and group definitions of a disaster and their plans for coping with it can appreciably contribute to realistic and purposive behaviour at a later date.

b) at the time of disaster impact or as soon thereafter as a research team can move into the area. During this phase, the 'false alarm' can be studied if it is feasible and appropriate.

c) about six months after the impact, the recovery and rehabilitation process of the community should again be studied, and this procedure should be repeated a year or so later. Ultimately, a third follow-up three to five years after the disaster should survey selected events. This plan is essential to an understanding of the effects of a disaster on social change.

According to Killian, unless the research topic is very narrow and specific, the schedule and the questions which compose it should not be rigidly structured (1956:22). The extensive use of open-ended questions is usually desirable. The experience of disaster victims usually contain many detailed incidents of which the subjects recollection may be comprehensive but somewhat disorganised: "His (the victim) reactions may have many nuances, some of which are revealed in fugitive, oblique remarks" (Killian 1956:22). The use of limited-choice, direct questions may obscure some other significant material or detail. Furthermore, the subject may find it difficult to describe his experiences and reactions in precise terms. He must be given freedom to try out different responses as he gropes for one that satisfactorily expresses the thing he is trying to convey.

> "If the researchers enter the field while rescue and clean-up operations are still in full-swing they are likely to find that many people do not have time to be interviewed. They may also find that there is pressure on them to become participants in these operations since the role of the scientists may appear callous and unsympathetic",
>
> (Killian 1956:30)

or may be misunderstood by the victim population, and the scientist may be mistaken as another relief worker. Later in the emergency phase or early in the recovery stage, certain advantages accrue to the researcher from a reasonably early entry into the field, By this time many people have the time, particularly in the final recovery stage, to co-operate as subjects, and the role of the scientist may be more acceptable to them. More importantly, there are indications that this is the time when it is easiest to gain rapport with the victims. Time and time again survivors of disasters have shown themselves eager to talk about their experiences in the recovery stage. The primary research tool here would be the interview, ranging from the structured and precoded instrument to the informal and unstructured one. There are no special problems in the interview technique that cannot be overcome with careful attention to the effectiveness of the schedule and the skill of the interviewer in obtaining and recording the data. Killian notes that

> "The greatest danger is not that the interviewer will appear unsympathetic to the respondent, but that he will become so identified with him that he drops the role of the scientific observer".
>
> (Killian 1956:23-4)

A further caution that Killian emphasises is that if researchers wish to gather material as accurately as they can, they must get to the disaster scene and commence research as soon as they can. People who have discussed their experiences with others (victims) in the community can rapidly assimilate inaccurate versions of the disaster. These 'group versions' may quickly become accepted by a large segment of the population (1956:30).

2) Use of Documents

Documents, both private and public, constitute an important source of data in the study of disasters. The use of public documents however (for example, newspaper reports) must be used with care. They are most useful when treated as sources of data complementing and supplementing first-hand data collected from the subjects themselves. News stories are useful, particularly in the early stages of a study for the general, though tentative, description of the disaster which they provide. Although the bias of writers must be kept in mind, use may also be made of official records and reports of operations prepared by public and private organisations. Information can be gleaned from such documents as newspapers and radio reports, personal documents such as diaries and letters, and the reports of surveys and investigations made by police, insurance agents, relief agencies.

3) Questionnaires

> "Perhaps it is because of the need for such a careful approach to the subject that questionnaires have been little used in disaster field studies.
>
> (Killian 1956:21)

The questionnaire method is inherently more impersonal than is the interview (the interview permits much more interaction between the interviewer and the subject). There is no reason, however, why questionnaires should not be used more frequently if:

> "1) a clear convincing covering statement indicating the sponsorship, the purpose and the possible significance of the research accompanies the questionnaire;
>
> 2) the research objectives are specified enough to permit the requisite data to be obtained with a brief instrument consisting of limited-choice questions; and
>
> 3) the sample or entire population can be reached more easily, efficiently and quickly through the distribution of questionnaires than through personal interviews".
>
> (Killian 1956:21)

The problems associated with questionnaires though may preclude the utility of them as a research method for obtaining precise data. The data obtained from questionnaires may only be a reflection of the attitudes of the respondents or, which is more likely to be the case, the response given in the questionnaire will be what the respondent thinks he should put down, or what he thinks the interviewer wants to receive. The probability that questionnaire responses will be an indication of the actual behaviour of the respondents is something that Oppenheim suggests is problematic when this technique is used to obtain social behaviour (refer Oppenheim 1972:7).

4) Probability Sampling

This technique has been used less frequently in disaster research than in other social science field studies. This is largely because conditions make it difficult to define, locate and reach the population to be sampled. In spite of the problems of sampling in a disaster area, probability sampling should be used as fully as possible whenever conclusions are to be stated in quantitative terms, for generalisation to any entire community or other known problems. This is particularly true when the findings relate to the frequency and distribution of various types of individual behaviour, attitudes or emotional reactions. More frequent use of rigorous sampling procedures is needed before the knowledge existing about the types of behaviour and events which occur in disasters can be translated into the knowledge about the frequency with which they occur under specified conditions. However, the use of sampling procedures is dependent on such variables as the size of the population in the impact area, the nature of the disaster community, and the hypotheses the investigator is testing.

Where physical destruction or evacuation have resulted in displacement of portions of the pre-disaster population, special problems arise. In this case it is necessary to reconstruct the composition of the pre-disaster population from available records.

5) Experimental Laboratory Techniques

Disaster is often said to constitute a 'unique laboratory' for the study of individuals and group behaviour under extreme stress. But a laboratory is useful only if we know what we want to study in it, and if we make observations and measurements systematically and relate them to hypotheses and theoretical models.

> "The 'disaster laboratory' has not been adequately utilized because little attention has been paid to the development of sets of propositions that can be tested as further disasters are studied; and because the methods used have not progressed from the laboratory to the systematic".
>
> (Merton 1969:LVI)

The reason why this is so could be because of the moral and ethical issues associated with laboratory experiments using humans as guinea pigs (refer McGee et al 1977:40-43).

Exploratory studies alert us to what we should measure and explain, but it requires quantitative surveys to tell us how 'typical' certain types of individual behaviours are and to show their relationships to social background and situational factors.

Experimentation is necessarily sharply limited by the fact that the extreme stresses of disaster situations cannot in practice be reproduced under controlled conditions. In the laboratory one can produce very frightening (and even traumatic) experiences, but must stop short of those which constitute a real threat to the existences and health of the subjects involved; actual disasters do not 'stop short'. An experiment cannot introduce the disaster stresses of overwhelming threat of life and limb, or sudden destruction of kin and intimates, of the pain and shock of personal serious injury and loss of homes and possessions.

The laboratory, however,

> "...makes it possible for researchers to test the adequacy of conceptualization by making the relevant processes happen under conditions of careful control and measurement. Although it is not always strictly the case, laboratory experimentation usually depends upon the definition of problems originating in our observations of nature and the development of theories about the processes that underlie what is observed".
>
> (Lazarus 1964:35)

4.3 Limitations on Disaster Research

The securing of data relatively free from bias is important to all social research, but the great emotional impact of disasters may bring about greater distortions than are found in most situations. The problem of securing the co-operation of the subjects does not seem to present great difficulties. Killian points out that "people are generally willing to speak of their disaster experiences if they feel that these experiences are not exploited" (Cisin and Clark 1962:27). Disaster field studies are beset with one particular problem probably even more than in most social science field studies. This is the difficulty in establishing controls over the variables to be investigated, either through experimental control, statistical inference or exhaustive in-depth study. There are a number of factors which operate to reduce both the quantity and quality of research on disasters and which, as a practical matter, can only partially be overcome. Wallace lists five factors: unobservability; interviewing the dead; time lag; relevance of clinical and laboratory observations; and the emotional resistance of researchers.

(1) Unobservability - Many types of disasters have inherent relative unobservability. Disasters, generally speaking, are so unpredictable as to place and time, that it is unlikely that any given team of trained observers will be in an impact area before and during an impact of the appropriate type. However, some disaster-agents can be predicted, for example floods, or else the period of impact is so long, for example epidemics, that observers can reach the impact area during the impact. Furthermore, an extreme situation is likely to be as extreme for the participant-observer as for anyone else, and if it is, he may be unable to make the desired observations or to preserve his records.

(2) You Cannot Interview the Dead - Those who did not survive an extreme situation are as important subjects of investigation as those who did, and in order to answer the question "Why did group A survive and not Group B?" some account ought to be taken of the behaviour of the dead prior to their deaths, if it can be obtained.

(3) Time Lag - In order to make an adequate study of a disaster, more information is likely to be required than can be obtained during the period of disaster itself, especially if entry into the impact area and access to local informants cannot be obtained immediately. Hence, any disaster study becomes in part an historical study, with some resulting advantages but some obvious disadvantages also, such as loss of records, defects and distortions of memory and dispersal of informants.

(4) Relevance of Clinical and Laboratory Observations - Generalizations from clinical and laboratory experience to practical disaster situations can undoubtedly contribute much, but the extent and relevance of clinical/laboratory findings is difficult to estimate because the total extreme situation cannot usually be reproduced in laboratories or clinics, and the usefulness of analogies is often a matter of opinion, not demonstration.

(5) Emotional Resistance of the Researcher - Extreme situations elicit extreme emotions and extreme behaviour. The researcher runs the gauntlet between being effectively swamped in the field situations and over-intellectualizing his approach. Any sort of field-work has emotionally strenuous moments and aspects: rejection by the subject; guilt over playing a passive role or an impersonal role in a situation where active assistance would be more appreciated (role conflict); misunderstanding and mis-handling the subject. On the other hand, over-intellectualizing either by way of quasi-obsessional efforts to 'interpret' behaviour in terms of some

system or psychiatric terminology, or a retreat behind a facade of methodological pseudo rigorousness and a refusal to observe any but the grossest and least emotionally tinged dimensions of the event, can result in virtually useless work.

> "Research on human behaviour in extreme situations requires a delicate balance of identification with the human object of research and of intellectual detachment".
>
> (Wallace 1956a:27-8)

One further point to note: No matter how narrow the interest and how well crystallized the design, every disaster field-study should make provision for securing an adequate description of the overall situation and sequence of events.

> "This is particularly important in disaster because situational variables are so often important in determining human behaviour; when it struck, what was destroyed or damaged; casualties, conditions of routes of egress and ingress; and similiar detail should be established. The general sequence of events should be discovered".
>
> (Killian 1956:7)

4.4 Methods in the Analysis of the 1968 Inangahua Earthquake Study

Research into the Inangahua earthquake began in 1978 and was conducted primarily by the use of two data-collecting techniques. The first involved a ten month period of document research into the earthquake, reading and taking notes from all the available literature published on the earthquake. Included in this ten month period was the gaining of access to and recording relevant information from Government and other organisational files and reports, not previously published. The second approach to obtain data began in October 1978 with a series of trips to Inangahua, Reefton, Westport, Greymouth and within Christchurch to interview people who had been living in Inangahua at the time of the event, or had been involved in the rescue/recovery of the township of Inangahua after the earthquake.

(1) Use of Documents

There were many publications on the Inangahua earth quake which concentrated on the geophysical, geological and seismological characteristics, and on the physical damage sustained during the earthquake (refer Bird 1969; Adams et al 1971, 1968; Shepherd et al 1970; New Zealand Society for Earthquake Engineering Journal 1969; Randal 1970; New Zealand Official Yearbook 1969; Westport Borough Council 1969). These provided useful sources for gaining a background and a working knowledge of the physical effects that the earthquake had upon the landscape, the building structures, and communication routes. The Ministry of Civil Defence, the Regional Civil Defence Organisations and Parliamentary papers provided initial information on the Government Departments' roles during the emergency and presented some preliminary insights into the social effects of the earthquake (refer N.Z. Ministry of Civil Defence 1970; House of Representatives 1968; Buller Combined Civil Defence District 1968). Publications presenting a generalized picture of the earthquake and the physical/social consequences were also available (refer Grayland 1978; Milne 1974).

Based on information extracted from the above sources, letters were written to the executive officers of Government Departments, organisations and associations that were actively involved in assisting the earthquake-stricken town of Inangahua, either by providing personnel or by deploying services, finance or plant to that town during the emergency or post-emergency period. These letters requested access to files on the earthquake and the names of any key personnel who were engaged on behalf of their Department/Organisation (see Appendix for a copy of the letter).

Response was exceptional; all the recipients replied to the letter of request (only one letter to each recipient was necessary before a reply was received), informing that documentation of their involvement in the Inangahua earthquake was available for research purposes; or that their participation was minimal and they housed no records concerning the earthquake. In all cases, the recipients provided names of key personnel, either within their own organisation, or of those persons in other organisations whom they believed could be of assistance. As a result of this exercise, files, reports and other documentation (for example, letters, newspaper clippings) were obtained from the following sources:

Civil Defence Organisation:	The Ministry of Civil Defence, Wellington
:	The Southern Regional Headquarters, Christchurch
:	Reefton Civil Defence
:	Westport Civil Defence

New Zealand Police Department: Christchurch
: Greymouth

New Zealand Red Cross Society (Inc.): Wellington
: Westport

Ministry of Works: Christchurch

County Council Offices: Reefton
: Westport (Buller County Council)
: Greymouth

Department of Education: Christchurch
: Nelson

Internal Affairs Department: Wellington

Ministry of Transport: Greymouth

Letters were also written, and interviews were held with specialists and experts for information not available in publications or files, that was necessary for obtaining precise details on some matters. Newspaper reports were obtained from the University of Canterbury Library, the Library of the Christchurch 'Press' Office, and from private individuals, which augmented data on the earthquake. These sources (the published articles, monographs, documents and files from organisations, letters and interviews, and newspaper reports) provided the framework from which the chronology of the earthquake, the effect of the earthquake and the stages of the recovery/rehabilitation were established.

(2) Interviews

In September 1978, a letter (see Appendix) was sent to fourteen (14) residents who were living at Inangahua in 1978 who were known to have lived in the area in 1968 at the time of the earthquake (these residents were selected by going through the 1968 Telephone Directory and the 1978 Telephone Directory; those names that appeared in both Directories were sent a letter). Of these 14, eight (57%) replied via the stamped return-address envelope provided, stating they would be willing to talk about the earthquake. A month later in October 1978, a further letter was sent to these eight people, thanking them for their reply and informing them that I would be in Inangahua the following week (see Appendix).

The first trip to Inangahua lasted four days, in which time the eight respondents were interviewed, using an unstructured interview technique conducted in the respondent's own home. All interviews were tape-recorded. The technique of data-collection was as follows:

1) I elaborated on the purpose of my visit, expanding the information which I had written in my letter to them, indicating the purpose of my visit and the interview.
2) I then asked the respondent to recall, in their own words, what they could remember about the earthquake. The purpose behind this strategy was to get the respondent to 'relive' the earthquake experience and to get them back into the situation which they had been in a decade before. I did not

interrupt or direct this period of the respondent recalling the earthquake in any way, but let the respondent feel his/her own way back into the earthquake situation.

3) After the respondent had exhausted his/her immediate recollection of the situation, we then went back over the period of the earthquake and the post-impact stages in a more structured format, with the respondent answering pre-determined questions. The questions were not asked in any order, but were put to the respondent in the sequence in which the conversation/interview was proceeding.

The above technique was used because of the long time-gap between the onset of the earthquake in May 1968, and the time of interviewing, which extended for months (October 1978 - August 1979). An interview technique had to be developed which allowed the respondents to recall the events that had happened a decade before with a high degree of accuracy and a well-developed chronology.

These interviews were then typed in full and were used as a guide to test if all the relevant information was gathered that was considered necessary for the completion of the study. Key personnel from Government departments and organisations were also interviewed, based again on the unstructured interview, either in the respondent's home or place of work. These respondents were asked different questions from those that were posed to the Inangahua residents; information from these personnel was required on the basis of their prescribed roles as well as their personal experience in the disaster situation.

Based on Coleman's "snow-ball sampling method" (1970:520), a resident of Inangahua, whom I came to know fairly well in the initial interview period, was contacted and asked if she could supply me with the names of as many people as she could, who had been in the 1968 earthquake at Inangahua, who I had not already interviewed, and who would consent to talk to me about the earthquake and their experiences at the time of the event. As a consequence, a further sixteen (16) Inangahua residents were interviewed, again using the unstructured interview technique applied in their own homes. In all, 24 people from Inangahua, representing 72 residents who were in Inangahua at the time of the earthquake (spouse and children), or 24 per cent of the total Inangahua township and surrounding farming homesteads were interviewed. A further eleven (11) respondents, representing various Government departments and organisations were interviewed, a total of 35 people. A list of the interviewees, along with a brief biographical sketch is attached (see Appendix).

All subsequent interviews were tape-recorded and transcribed in full. The task then, was to see if, and how well, the respondents experiences and actions at the time of the earthquake, and immediately after the disaster, fitted into Powell and Rayner's model of disaster-time.

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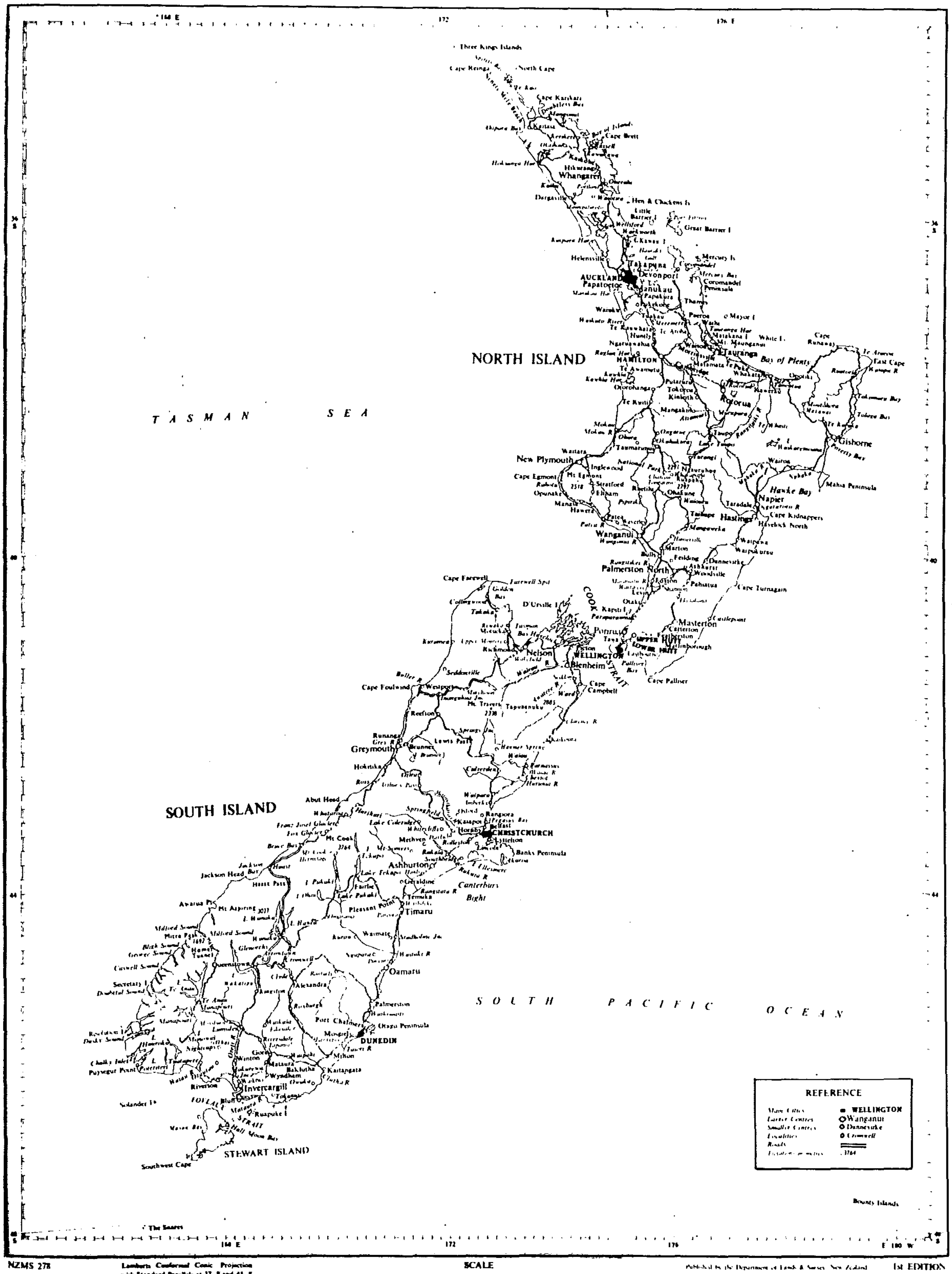
NEW ZEALAND



NZMS 278

Lamberts Conformal Conic Projection
with Standard Parallels at 37 S and 45 S

SCALE

50 0 50 100 150 200 Kilometres

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CHAPTER V

THE INANGAHUA EARTHQUAKE

5.1 Introduction

Almost all of the literature on natural disaster research refers to disasters that are large-scale, either in terms of geographical area, monetary and material (physical) loss, human loss of life and/or injury, or a combination of the above. The propensity of large-scale disasters predominating in the literature leads one to question whether the use of models and general observations that have been proposed will have applicability for those disaster situations that are not 'Large' in terms of geographical area, economic cost or human loss.[1]

The 1968 earthquake, although it was felt throughout New Zealand, was relatively confined in its destructive damage. The focal area was the West Coast, South Island township of Inangahua, a settlement of about one hundred dwellings and buildings with a population of about 250. Reefton, Greymouth, Westport and Hokitika (the principal West Coast population centres with a combined population of 17,130 in 1968[2]) felt the effect of the earthquake to some extent, but damage in these areas could in no way be considered disastrous or completely destructive.

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[1] A disaster may occur in accordance with the definition of disaster proposed in Chapter I, yet may not be large scale in terms of the characteristics above.

[2] New Zealand Official Yearbook 1969, pp. 67-68 (Government Printer, Wellington).

In terms of money loss, the Inangahua earthquake (Richter magnitude 7) disaster, even by New Zealand standards, was relatively small. The cost amounted to $NZ 4.2 million. Compare this with other 'large-scale' earthquake disasters throughout the world - the 8.3 Richter magnitude 1906 San Francisco earthquake which cost $US 350 million; $US 190 million for the Anchorage (Alaska) earthquake, which registered 8 on the Richter scale; and $US 500 million for the 1972 5.6 Richter magnitude earthquake in Managua (Nicaragua) (Haas et al, 1977).

In terms of human life lost, the 1968 Inangahua earth quake had minimal loss of life - one dead as a direct result of the earthquake, two more indirectly, and another three as a result of a helicopter accident in the recovery period: a total of six dead. This represents 0.6 per cent of the total population of the Inangahua township area. The 1972 Managua earthquake left 1 per cent of the 405,000 people dead (over 4,000) and 16,000 injured; the San Francisco earthquake left 550 dead and 220,000 homeless in a city of 400,000 (approximately 0.1 per cent of the population dead). The 1976 Tangshan (China) earthquake (7.8 Richter magnitude) left an unknown number of dead (statistics have been unavailable from official sources), but it is believed to run into the tens of thousands; in the 1979 Yugoslavian earthquake, the resort town of Kotor was completely devastated with the resultant loss of 200 lives.

On the scale of the above earthquake disasters, the Inangahua earthquake was not large scale. But nevertheless it was one in which a habited geographical area was devastated by a natural disaster. The differences between Inangahua, San Francisco, Managua, Anchorage, Tangshan and Kotor are differences in scale (both in terms of the magnitude of the earthquake, but more importantly, in terms of population density, and type of buildings), not kind, and unless it can be proved that scale affects individual attributes in a disaster situation, the research that has been carried out in this area of natural disaster research should be appropriate for the analysis of small-scale disasters such as the 1968 Inangahua earthquake.

Some features are bound to be different because of the number of people living in the area and the life-styles that the people have adopted. Inangahua, for example, has no multi-storeyed apartment buildings or large commercial buildings; no major industrial, commercial or residential area; no major internal motorways or complex transportation systems, nor a dense vehicle population (all characteristics of large cities); it has no industrial plant to shut down; and most of the population in the Inangahua district are involved in primary as opposed to secondary interactions.

There are other conditions that may affect the responses of people living in small rural communities that are different in kind to those that are believed to exist in larger communities. For example, it is probably more universal that family members are greater distances apart at certain times of the day in large cities than they are in smaller communities, and the members who are separated from the family will be different (for example, in the city, the working father is more likely to have to travel greater distances from his home to his place of work; whereas in the rural communities it is the children who have to travel further from their homes to school - a 50 kilometre round-trip each school day for the post-primary school children living in Inangahua). The relative isolation of the farming homesteads, combined with the greater primary interaction that is characteristic of rural communities may compound anxiety levels if the family units are cut off from their neighbours by the disaster agent.

No research has been undertaken to determine whether these differences do exist and if they play any role in the social behaviour of people in small communities that have undergone a 'crisis situation' (Stallings 1973:318). The Inangahua earthquake study may provide the initial findings for such comparative research.

5.2 Pre-Emergency State

5.2.1 Pre Warning. The Inangahua Area Before Impact

A) A Short History of the Inangahua Junction Region

To the average New Zealander, mention of the West Coast conjures up visions of rugged mountains, forests, rain, gold and coal. Inevitably the mind seems to drift back to the past, especially to the 'Golden Era' of the 1860's, with visions comparable to the American 'wild west' at its best.

The early history of the West Coast goes back to the middle of the seventeenth century when Tasman sailed along part of the coast and reported a "large high-lying land". Not until Cook sailed past in 1770 was the West Coast again seen by European eyes. His summing up - "No country on God's earth can appear with a more rugged and barren aspect as this" - gave little incentive for further investigation.

In 1846 Charles Brunner set out from Nelson settlement to explore the West Coast and to investigate its resources and potentialities for settlement. Brunner passed through the area now known as Inangahua on April 10, 1847, when he went through the junction of the Buller and Inangahua Rivers. He was the first to report on the coal deposits of the area, but his main impression was of bush-clad mountainous country with few resources, and no prospects for settlement. His report aroused no interest in the area, and it was over ten years before further investigations were carried out. In the 1850's explorations, coal, timber, gold and open land supposedly capable of agricultural development were reported.

The beginning of the gold industry in New Zealand may be dated from 1857 (Harrop 1923:41). In 1864-5, 6,000 diggers left the Otago region and the majority crossed over the Southern Alps to the West Coast. From 1865 Westland ranks as a great gold-producing region, and in 1866 mining was beginning in Inangahua. In December 1862, Simon Epapara, a Maori, discovered gold at the Lyell which led Europeans to the area. They would have had to pass through the area of the junction of the Buller and Inangahua Rivers to get to the mine area. John Redman discovered gold in the Inangahua Valley in 1866, near Cronadun at Redmans Creek. This led to a rush into the area. The alluvial mines were supplied by boats coming up from Westport through the river junction to Inangahua Landing.

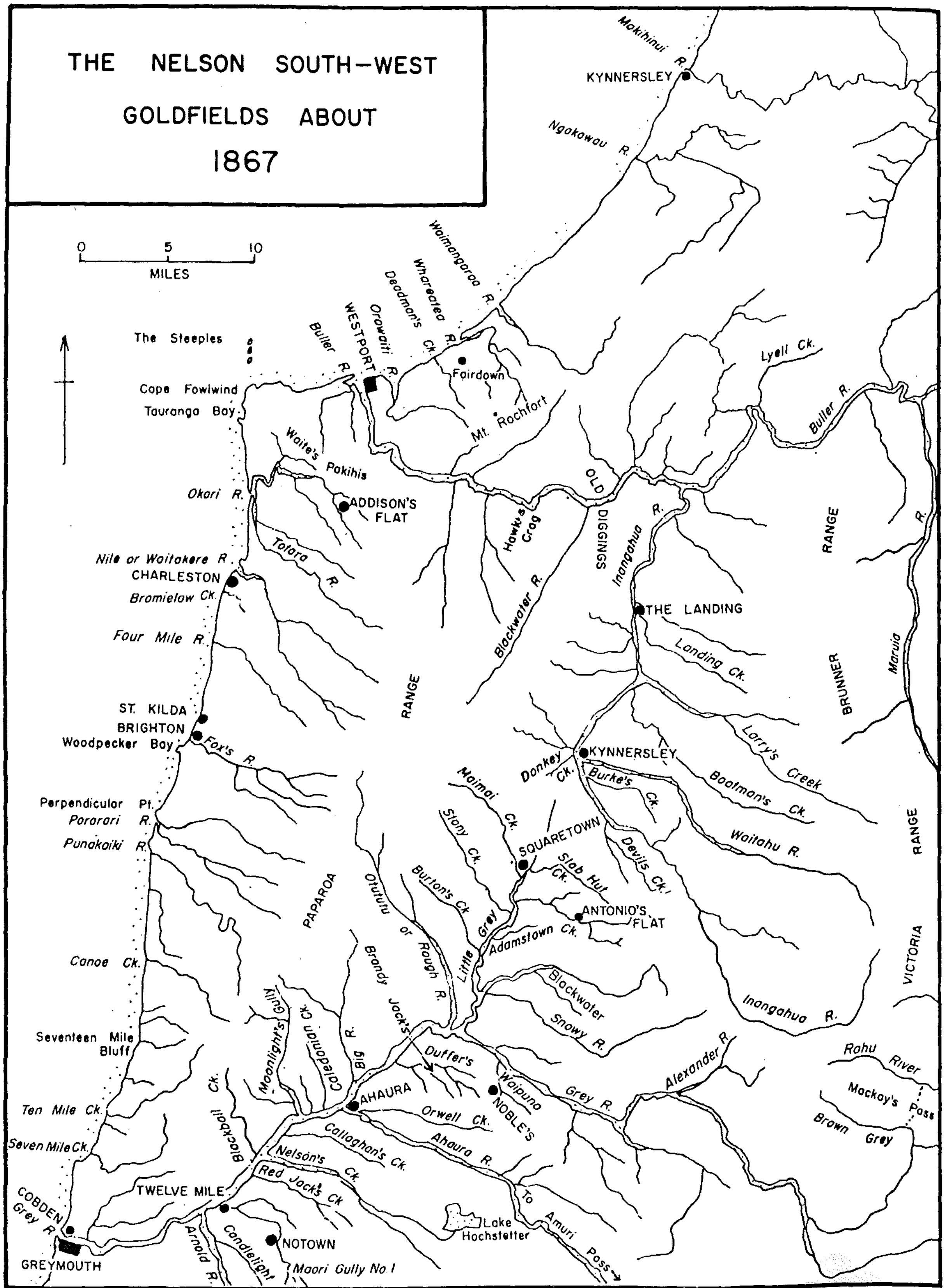
A thousand men were working in the tributary creeks of the Inangahua searching for gold (see Map I) in 1866. But the Inangahua area had poorer fields than other Westland areas - by 1870 the area was almost deserted. This was compounded by the fact that there was a high cost of bringing in supplies by packhorse or canoe to the Inangahua Valley. Boat traffic up the Buller River and the Inangahua as far as Emmanuels Flat (The Landing) started. In favourable conditions boats could work the Buller up to the Landing confluence, then up the Inangahua River to the Landing, the farthest that a small boat could reach (refer Map II).

In 1867 William Lloyd was granted a free Publican's licence at Inangahua Junction provided he kept a ferry-boat available at all times. He was probably the first in this area with a hotel. From the list in the Sale of Spiritous Liquors, under the 'Goldfields Licensing Act 1872' comes the following information about the Inangahua Junction area:

- Inangahua crossing - G.W. Thompson, Fee 15/-. Conditions: good accommodation for travelling. Good lamp to swim horse over the Inangahua.
- Half a mile below the Junction of the Inangahua and Buller Rivers is William Stewart. Fee 5/-. Conditions: Good accommodation for the traveller.

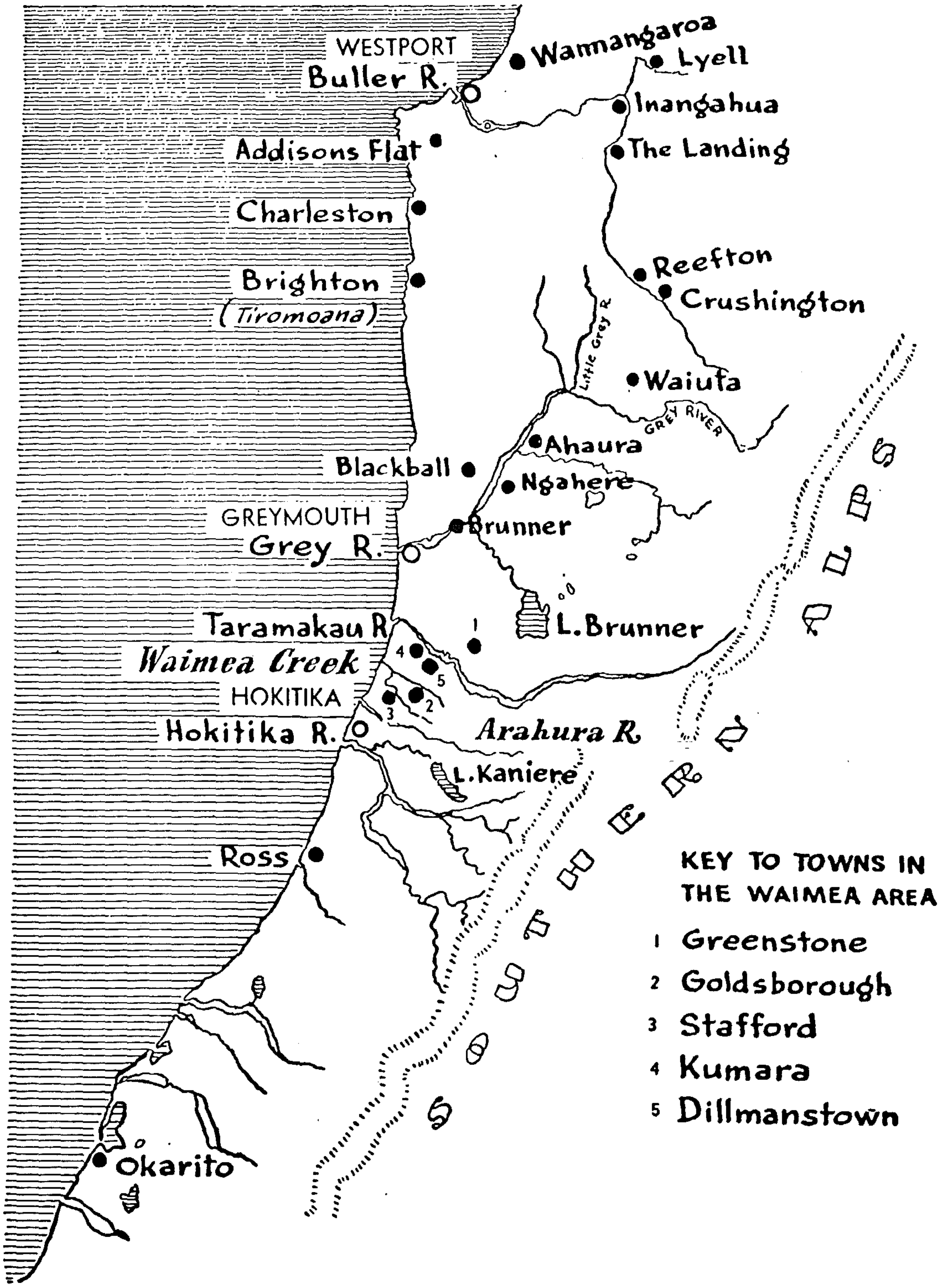
MAP II: THE NELSON SOUTH-WEST GOLDFIELDS ABOUT 1867

Source: May P.R.: THE WEST COAST GOLD RUSHES (PEGASUS) 1967: 218



MAP III: LOCATION MAP OF THE WEST COAST GOLDFIELDS

Source: Millar J.H.: WESTLAND'S GOLDEN SIXTIES (A.H.& A.W.REED,Wellington 1959:frontspeice



GOLD ON THE COAST

Most of the West Coast goldfields were developed during the 'sixties. Those that came later were Addisons Flat, Charleston, Brighton, Dillmanstown, Ngahere, Blackball, Waiuta, Crushington, Reefton and The Landing.

- At the junction of the Inangahua and Buller confluence is Reuben Waite. Fee 10/-. Conditions: Ferry boat over the Inangahua.
- Crossing of Inangahua to Lyell by Christian Minderman. Fee 10/-. Conditions: Good accommodation. Good lamp. Ferry boat on Inangahua River.

The Inangahua Junction is at the confluence of the Inangahua and the Buller Rivers. Inanga means 'whitebait' in the Maori language; hua probably refers to the preserving of the fish by drying in the sun and packing into hermetically sealed containers. The settlement was once known as Christy's Junction. Christy's Junction was named after Christian Minderman and most maps around 1872 show it as such. Christian Minderman emerged as the key personality of the area.

It seems that the Junction of the Buller and the Inangahua was also given the title of Charles Junction (date unknown). This would appear to be after 1872 because Charles Broad, who was the first Warden and resident magistrate of the Inangahua Goldfields, paid regular visits to the Lyell to hold court after this date. This must have only been a local name for the area because Christy's Hotel was the site of a few court sittings under Dr. Joseph Giles, Warden and resident magistrate of Westport in November, 1870. These sittings were given the official title of the Inangahua Junction Warden's Court.

The Inangahua River also has had a name change, the river was first named the Thackeray, but this name was soon dropped.

Inangahua Junction is a farming and mining district at the confluence of the Inangahua and Buller Rivers. The settlement is on the south bank of the Buller and on the west bank of the Inangahua. It is in Boatman's Riding of the Inangahua County in the electoral district of Nelson. The Junction is 26 miles (41 Km) from Westport, 12 miles (19 Km) from Lyell, and 111 miles (177 Km) from Nelson (refer Map III).

Around the early 1860's roads and tracks permitted a six-day journey from Nelson to Westport, a distance of 150 miles by dray. This communication link went via Inangahua Junction. The Junction was established because of the coach road to Westport. Coaches arrived daily from Reefton and Westport, and twice weekly from Nelson. Earlier, John Blacket, a young and vigorous Provincial Engineer, presented a report on a special survey of the whole of the Buller region. His plan called for the laying out of a township where the Inangahua joined the Buller River, and a ferry for the ford so that prospectors could carry on up to the Lyell Creek digging area. The road to Reefton was constructed in 1872.

In the closing months of 1867 a reconnaissance survey had begun for a railway line down the Buller Gorge to Westport with another by way of Inangahua, Little Grey River and the Grey Valley to Cobden. During the development of the railway on the West Coast there have been shifts of emphasis in the commodities carried and the importance of various stations. The three main stations, Greymouth, Hokitika and Westport,

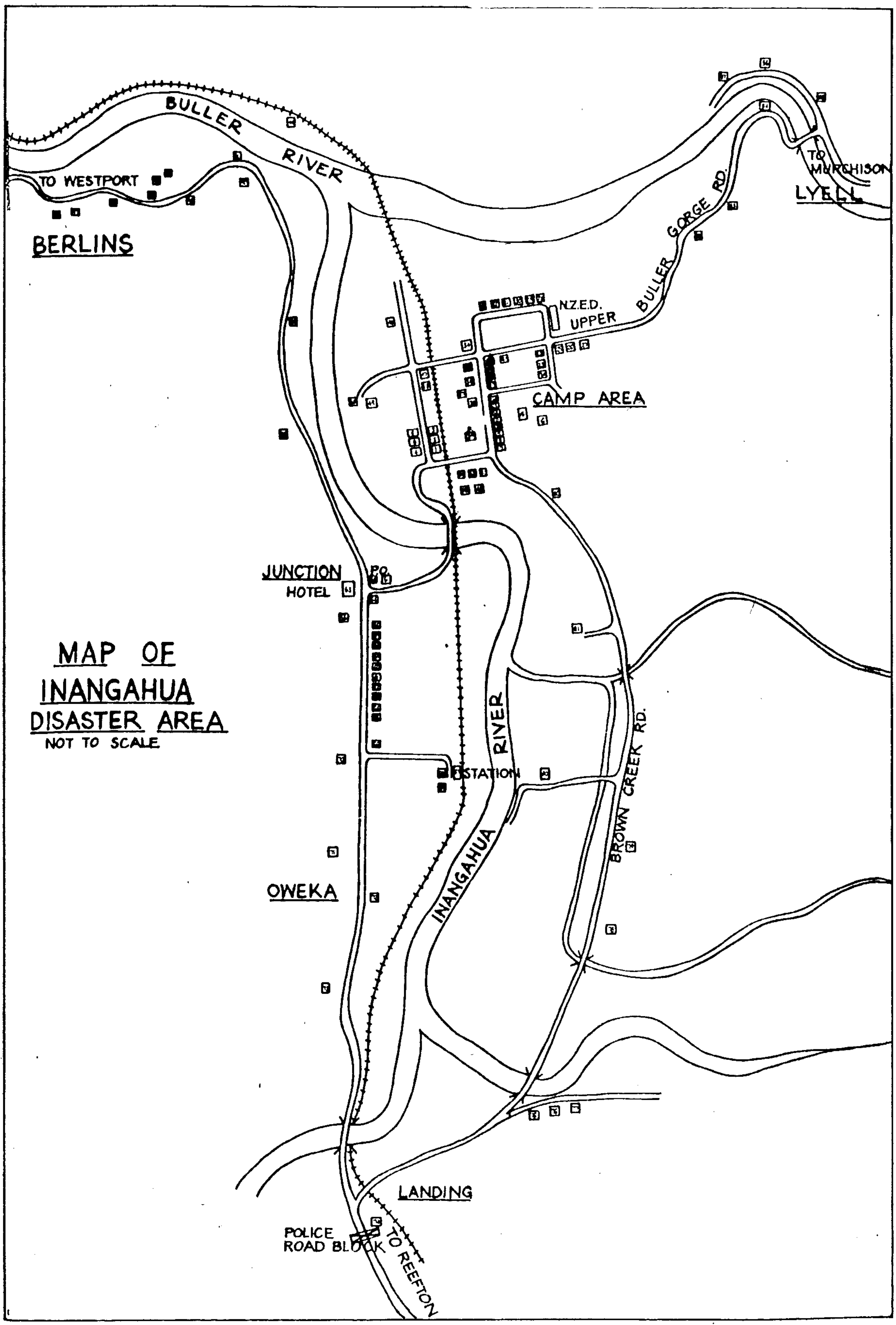
MAP IV: MAP OF THE NORTHERN REGION OF THE SOUTH ISLAND, NEW ZEALAND

serve as rail depots with a minor depot at Inangahua Junction. The Reefton-Inangahua section of the railway was commenced in 1903 and completed to the Junction in 1914. The Westport-Inangahua Junction line was completed in 1940. Today, much produce, including all the export butter produced in this region, is sent by truck to the Junction, then by rail to Lyttelton (Christchurch) or to other South Island outlets. Road freight volumes through the Junction have increased over the years.

The Inangahua township is surrounded by State Forest. This region, in its heyday, produced almost 12 per cent of the West Coast Timber. The economic function of the Junction area in the 1960's, apart from the farming interests were:- most employment was provided by the Ministry of Works, two sawmills, a New Zealand Electricity Department substation, plus the Railway Department, a truck depot, a hotel and two contracting firms. There was also a Post Office, a two-teacher primary school, a butcher's shop and a church. In 1968 the population of the township was approximately 240 (in 1901 the census figure was 98). In 1968 Inangahua was really two settlements: the Junction and 'The Camp'. They are exactly one mile apart with the Inangahua River running between them. The Junction's centre is around a hotel, a Post Office, the local primary school and a store. The 'Camp' is the popular (Map IV) name given to the Ministry of Works residential settlement. Shortly after the 1968 earthquake the two sawmills closed down, the hotel closed, as did the tearooms. The 1979 population stands at 135.

MAP V: MAP OF THE INANGAHUA DISASTER AREA

Source: Hamblett S.G.& Yeatman in BULLETIN OF THE NEW ZEALAND NATIONAL SOCIETY FOR EARTHQUAKE ENGINEERING Vol 1 1969 p 95



B) Counter-Measure Agencies in the Inangahua Area

Agencies or organisations, part or all of whose mission is to prevent, mitigate or relieve physical disaster, are usually found in most areas of large population settlements. This includes such agencies as the Police Department, the Fire Department, hospitals, ambulance services, doctors, Civil Defence, Red Cross, the Salvation Army, Church organisations and other volunteer organisations.

Because of the population size, the township of Inangahua Junction had no institutionalised agencies for the prevention, mitigation and relief of disasters, All these services, if needed, had to come from outside the township. The township was too small to have its own police force. The policeman stationed at Murchison, 50 kilometres away, had Inangahua township within his jurisdiction, and he visited the settlement every week. The nearest fire station, a volunteer organisation, was situated at Reefton. The nearest permanent fire station personnel were at Westport, 50 kilometres to the west. Inangahua Junction had no doctor, but one of the residents was a qualified nurse, who proved invaluable as the drama of 24th May unfolded.

Reefton Hospital was the closest medical centre for Inangahua. There was no Civil Defence organisation in the Inangahua community; in fact the Civil Defence organisation was in its infancy throughout the West Coast region. A Civil Defence plan was outlined for the Reefton-Inangahua area and was presented to the Regional Commissioner at Christchurch in 1964. The plan though was based on Reefton and all the personnel resided in that township. The swearing in of personnel to form the Reefton Civil Defence occurred in 1965 in the Inangahua County Council Chambers. On 7 October 1965, the initial meeting of the Reefton Civil Defence Police was held. In September 1967 the Reefton Civil Defence organised an exercise to simulate a disaster - 'Operation Hotspot' - presupposing that an earthquake confined to the central section of Broadway (the main street) had occurred during the early hours of the morning and a fire had swept through the shopping block. This was the first and last exercise that the Eeefton Civil Defence organisation carried out before the earthquake of 24th May 1968.

In November 1967, one of the Inangahua County Councillors and a member of the Reefton Civil Defence organisation attended a Controller's Course at Lincoln College, Christchurch. In December 1967 another Councillor attended a Civil Defence Warden's Course at Lincoln College.

In April 1968, the Reefton Police constable, who had been engaged in the instigation of the Reefton Civil Defence, discussed the existing Civil Defence plan at the Council meeting. He pointed out the plan had serious flaws in it as it stood, and, as such, it should be altered. A remit was passed to discuss this suggestion in full at the next Council meeting on April 30, 1968.

On 30th April 1968, the Police constable gave his proposal for a different format of staff requirements for Civil Defence personnel. All Civil Defence positions were filled, people appointed to positions that had previously been vacated because of movement away from the township. A meeting was arranged to be held on 2nd May 1968, bringing in the Council and the new appointees to the Civil Defence fold. On 2nd May the Reefton Police Constable detailed individual duties and answered questions by the new appointees. He stated that each officer should endeavour to provide a plan for their particular section within the overall context of the Reefton Civil Defence plan. A meeting was arranged for 30th May 1968 to discuss these plans, which would detail the functions of the various sections and their personnel in the event of a disaster in the area....

C) <u>The New Zealander and the West Coaster</u>

Attempts to assess the 'social climate' of New Zealand, or to portray the 'New Zealand character' rests on a very tenuous foundation. A more tenuous assessment exists when attempting to portray the 'West Coast character', although it is regarded as a 'fact' that one can tell a West Coaster a mile away:

> "Many New Zealanders in other cities can pick a West Coaster almost immediately, sometimes after hearing only a few words. That is because, although the Coasters like to consider themselves as a collection of individuals, many of them have characteristics of speech,mannerisms, and of an attitude toward life in general, and authority in particular, which speedily stamps them as coming from the western side of the Southern Alps".
>
> (Hobbs 1959:145)

There is agreement of specific features of the New Zealand character (Hobbs 1959; McCaskill 1966; Hall 1966; Mitchell 1972; Johnston 1976; Milne 1966; Willmott 1975;

Parr 1974). One outstanding feature of New Zealand life is its tendency towards equality (Willmott 1975; Parr 1974; Mitchell 1972; Johnston 1976). Parr, in his paper states:

> "A high degree of commitment to an egalitarian ideology to all levels of life, including the national, is a cultural value that makes New Zealand society unique in comparison to most democratic societies. The development and operation of social welfare programmes, plus considerable equality of incomes are characteristic of New Zealand life that are not manifested to such a high degree in many other societies".
> (1974:5)[1]

New Zealand also owes much of its national character to the smallness of its population (Mitchell 1972:20; Willmott 1975; Parr 1974:3). This smallness of population leads to other characteristics, for example, a high level of public morality. Willmott states that the high degree of trust, the willingness to go out of one's way, "even to take risks (1975:26) for the benefit of strangers," and a strong commitment to the Commonweal are attributes of New Zealand culture that comprises what he calls "a high level of public morality" (1975:26) that distinguishes New Zealand culture and life styles from other western societies.

Another prominent New Zealand characteristic is pragmatism (Milne 1966:8), what Siegfried called the lack of "principle, convictions, reasoned beliefs" (1914:62). Milne also states that it "is not difficult to find evidence of social conservatism in New Zealand" (1966:8-9; see also Mitchell 1972; Johnston 1976:29).

---

[1]This point of view is now under some criticism, particularly in more recent years, arguments have suggested that inequality is growing (refer George Bryant, The Widening Gap: Poverty in New Zealand, (Cassell, New Zealand) 1979; Kilmartin C. and Thorns D.C., Cities Unlimited (Allen and Unwin, Australia), 1978).

West Coast inhabitants are regarded as being an exaggeration of the New Zealand character, they are rougher, tougher and drink more, have less regard for the law, reflect the pioneer tradition and are hard-working outdoor types. Further, the West Coast itself is regarded as a 'frontier society' (Kay 1966; Hall 1966:29). Hall states that the West Coast conditions are still "more primitive than most other parts of the country" (1966:29). The West Coast region, because of this "cultural and physical barrier" (Ward 1976:22), and because the region is still regarded as an "economically depressed area" (Franklin 1976:279-80), has offered a partial explanation why the inhabitants of the West Coast have a greater sense of isolation, and they have engendered a greater sense of community (Hobbs 1959: 148, 149). This has also resulted in a deep attachment to the region and to fellow West Coasters (Ward 1976: 22; Hobbs 1959:148).

New Zealanders have long recognised the distinctive qualities of the narrow rain-drenched strip of lowland, known simply as "The West Coast" - there is little fear of confusing it with any other west coast in New Zealand (McCaskill 1966). Extractive industries, gold mining, coal mining and timber milling have formed the basis of settlement in contrast to the prevailing New Zealand economy which is primarily based on grassland farming and livestock rearing. Mines, timber mills, logging, gold mining, quartz mining and dredging are more hazardous occupations than many other types of occupation.[1] As well as the high rate of industrial accidents, the West Coast has had a long tradition of both man-made and natural disaster/emergency situations, ranging from mine explosions, floods, bushfires, tunnel collapse, hurricanes and earthquakes (refer Grayland 1957: 1978; Soil Conservation and River Control Council 1957). The contribution of these disaster/emergency situations, and the high rate of accidents associated with hazardous occupations may contribute to the West Coast people adopting processes that have enabled them to internalize the consequences of crisis situations. They may have a higher level of preparedness due to greater experience of prior crisis situations.

D) Earthquakes in the Inangahua Area

Between the June 17, 1929 (Murchison) earthquake and the May 24 1968 (Inangahua) earthquake, there were 110 earthquakes of Richter magnitude 4.5 or above, that had their epicentres between latitude 41-43 degrees and longitude 170-173 degrees

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[1] In the Greymouth Department of Labour area (which covers the West Coast district), 50.7% of all reported industrial accidents were recorded in mining and quarrying jobs. The remainder (49.3%) were received by injuries sustained in agriculture, forestry, hunting, fishing,manufacturing, commerce, transportation and storage, and tertiary industries (refer Report on the Industrial Accidents Statistics of New Zealand Department of Statistics 1963, page 39.) By 1968 the percentages had remained similar - 49.7% of all accidents registered in the Department of Labour,Greymouth, resulted in mining and quarrying (1968:26). Taking the case of the mining and quarrying occupations and the resultant accidents in 1961 36% of all such accidents reported in New Zealand were recorded in the West Coast district. By 1968 this percentage had risen to 44% (1968:26). In 1961, 30% of the West Coast population was involved in mining and quarrying, forestry and logging. By 1968 this percentage had fallen to 24.7%. Notice the decline of involvement within this occupation group but a rise in the accident rate (refer Report on Prices, Wages and Labour Statistics of N.Z. (Dept. of Statistics), 1962:61; 1969:62).

(the Inangahua earthquake epicentre was 41.77 degrees, 172.01 degrees).[1] It is taken for granted that the majority of these earth tremors were felt by the people of Inangahua Junction who inhabited the township during 1929-1968. Simpson-Housely narrows the geographical area further and states that "(In) the Reefton area between 1925 and 1975, 28 earthquakes of Modified Mercalli 5 or more have been recorded" (1976:79) (refer Appendix for charts on the Richter Magnitude Scale and the Modified Mercalli Scale (Intensity) for earthquake assessment). It is almost certain that these 28 earthquakes would have been felt in the Inangahua Junction. These figures suggest that the inhabitants of the township were relatively familiar with earthquakes occurring, though not necessarily familiar with the consequences of damaging earthquakes (the last 'sizeable' damaging earthquake in the region was in 1962 when a 5.9 earthquake occurred with an epicentre off the Westport coastline). Such suggestions that have been made in the last sentence have more weight attributed to them by Simpson-Housely's study of Reefton residents: the frequency of past earthquakes aided the Reefton respondents in anticipating future seismic problems (1976:ii). The fact that the inhabitants of the area were unfamiliar with the consequences of earthquakes is supported by Simpson-Housely's finding that the residents response of denial of the earthquake threat is

> "...a positive function of topophilia (love of place) and that ataraxy (freedom from disturbance of the mind) is a property of most of the respondents in relation to the respondents cognitive knowledge of the earthquake hazard".
>
> (1976:133)

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[1]Earthquake numbers derived from New Zealand Earthquakes computer readout published by the Seismological Observatory Geophysics Division, D.S.I.R., updated to 13 February 1979.

5.3 The Emergency States

5.3.1 Warning
5.3.2 Threat

According to the model developed by Powell and Rayner, these two periods come into existence after there has been acknowledgement on the part of people in positions of authority that danger may arise from a perceived natural hazard, and before that perceived hazard manifests itself into a disaster situation, that is, just prior to impact. Stallings says that the term "threat" conveys the connotation of potential disruption of existing social structure (1973:314). He goes on to state that "Theoretically, any event or condition has such potential, but the probability of crisis generation differs widely". Threat, then, implies something more positive than potential disruption; the perception of an imminent hazard is also important. The warning and threat periods are dependent on the 'perception' of a threat or hazard. Miletti et al define perception of a hazard as

> "...an individual's understanding of the character and relevance of a hazard for self and/or community. The perception may include notions about speed of onset, scope, intensity, duration, frequency, temporal spacing, causal mechanisms and predictability".
>
> (1975:23)[1]

---

[1] For a discussion on the perception of hazards, refer Miletti et al, Chapter II: "Anticipating Disasters". Miletti in Chapter III of the same book offers a discussion on the warning process and the response to impending environmental hazards.

There did not appear to be any warning of the May 24, 1968 earthquake. Unlike the 1929 (Murchison) earthquake, where earth rumbles were

> "...reported to have been audible the day before the main shock and slight earthquakes were felt about 1.30 and 7.20 on the morning of the disaster"
>
> (Henderson 1937:96)

(the main shock occurred at 10.24 a.m.), there has been no mention by any residents of the Inangahua area, nor any evidence from seismological data that there were any foreshocks before the 5.24 a.m. earthquake on May 24. (The D.S.I.R. computer files on New Zealand Earthquakes shows that the last earthquake preceding the (Inangahua) shock was located in the Taranaki area (400 Km north) on May 20 1968. It is unlikely that this earthquake acted as a precursor for the Inangahua population). That foreshocks occur prior to main earthquakes has often been reported (Rikitake 1976:289), but they are unreliable as indicators of future shocks.[1]

Several observers reported unusual animal behaviour at different times before the main earthquake in Inangahua. Two of them, one at Inangahua, the other at Oweka, claim to have been awakened at 5.15 a.m. by cattle and sheep noises which, at that time in the morning - two hours before sunrise - was very unusual. But the absence of any small foreshocks recorded by the Kaimata seismograph makes it unlikely that an earthquake was responsible for the upset of the animals,

---

[1]Richter pointed out that "foreshocks seldom afford any opportunity for warning or prediction of major earthquakes since there is nothing to distinguish foreshocks from ordinary small shocks". (1958:67)

(Adams _et al_ 1969:14). The Oweka observer also reported a flash of light[1] beyond the Buller River in a northerly direction, the direction that was to become the epicentre (Adams _et al_ 1969:14). Unusual animal behaviour was also recorded during interviews by two respondents. One respondent recalled that a normally placid horse was very unsettled the day before the earthquake, running up and down its paddock, bucking and neighing. The second respondent reported that about ten minutes prior to the earthquake on the Friday morning, he had to get up and let his cat out of the house because it was running furiously up and down the hall in a highly uncharacteristic manner (the cat was not seen for several days after the earthquake). None of these abnormal animal activities were associated at the time with a forthcoming earthquake.

5.3.3 Impact Prologue

In the early morning of Friday 24 May, 1968 at 5.24 a.m. local time, a shallow earthquake of Richter magnitude 7 occurred about fifteen kilometres north of the town of Inangahua. The earthquake was felt over most of the country, with Modified Mercalli intensities reaching MM X around Inangahua (Maps V and VI). It became the sixteenth New Zealand earthquake to reach Richter magnitude 7 or greater since 1848 (Adams _et al_ 1968:7).

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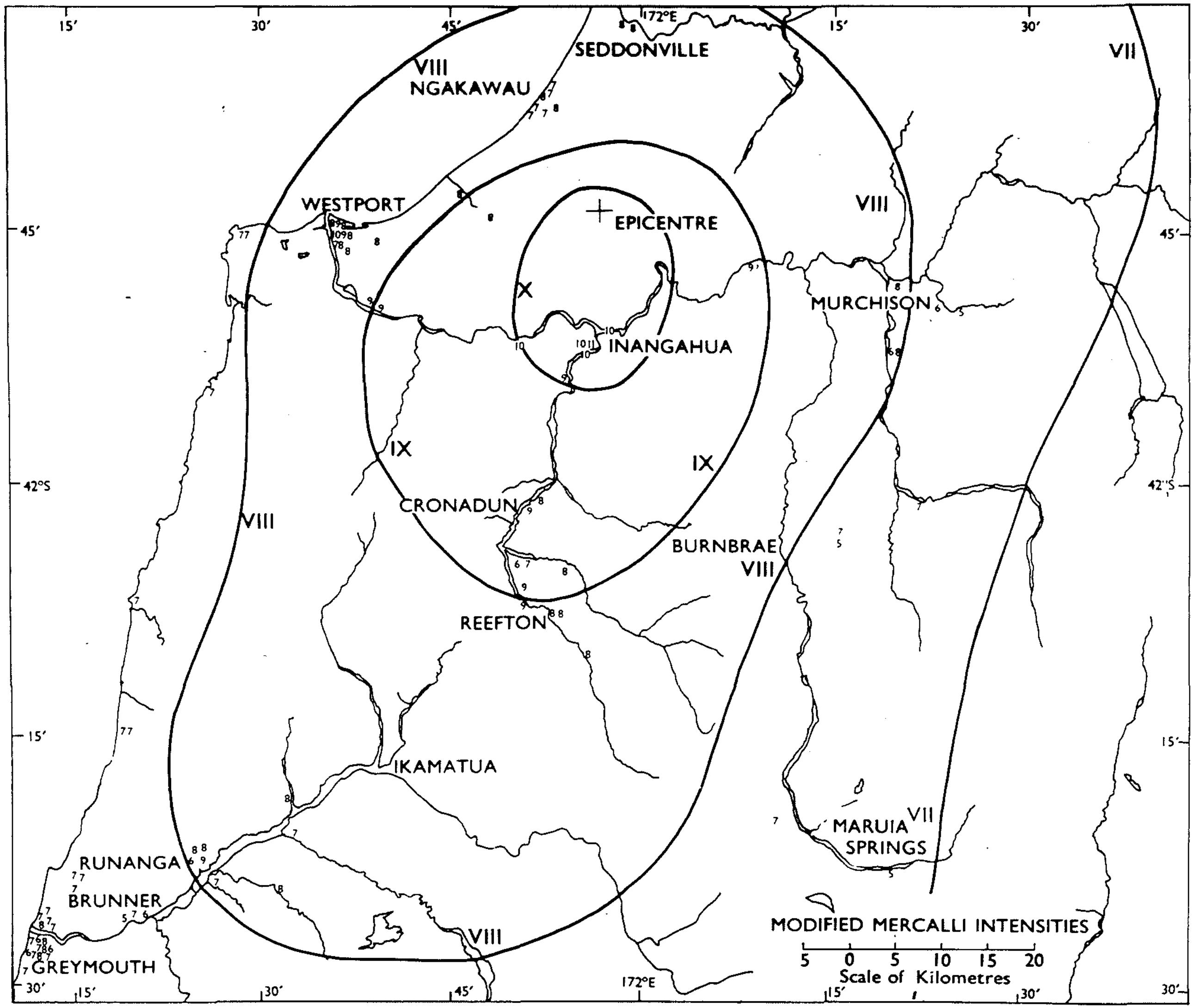
[1] For further information on 'earthquake lights', refer Weisbecker _et al_ 1977:83; Earthquake Information Bulletin Vol. 9, No.9, May-June 1977, 17-21; Derr, J.S., Earthquake Lights: A Review of Observations and Present Theories, Seismological Society of America Bulletin, Vol. 63, No. 6, 2177-2187.



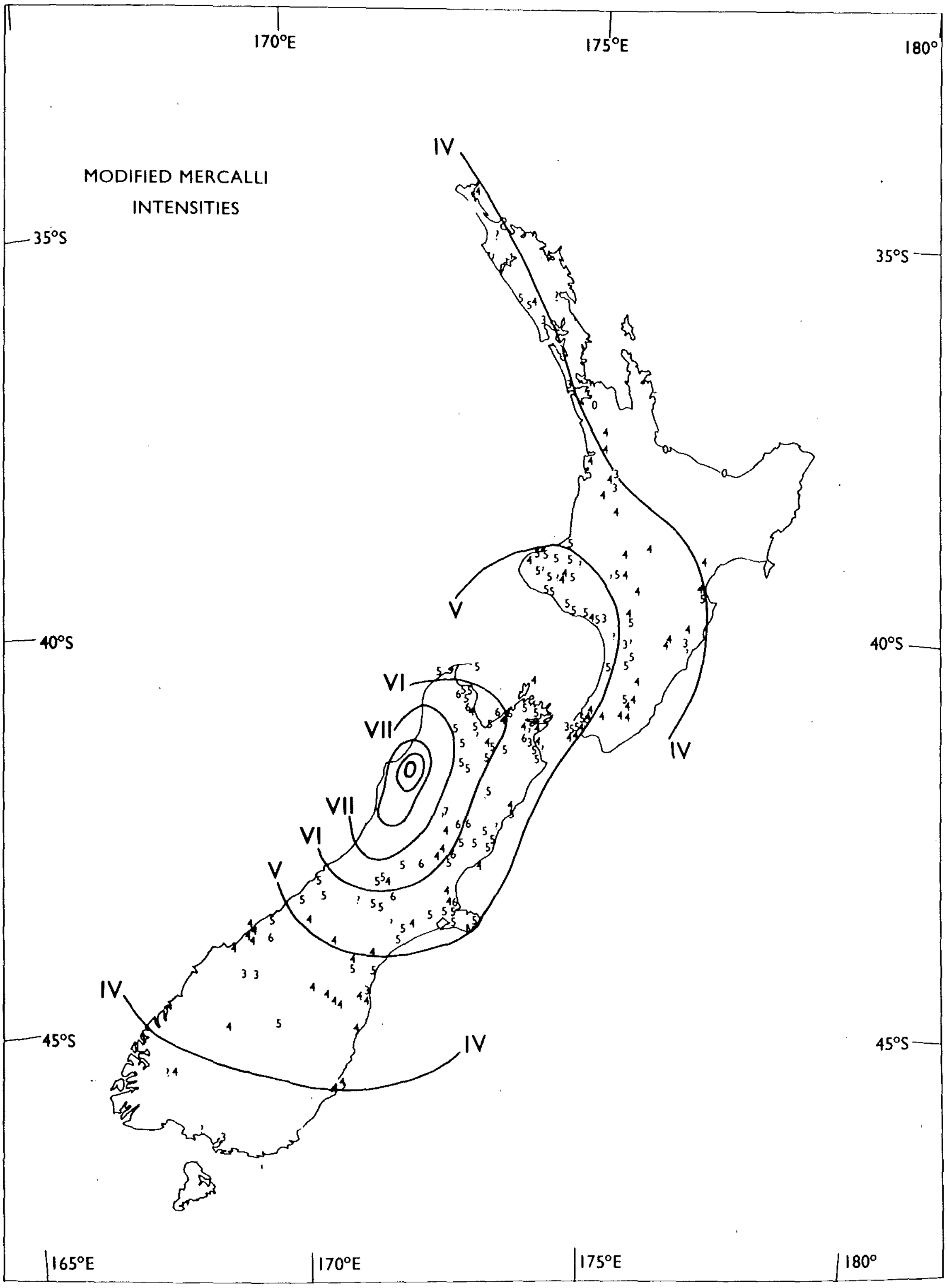
Isoseismal map of epicentral region of main Inangahua earthquake.

MAP VI: ISOSEISMAL MAP OF EPICENTRAL REGION OF THE MAIN INANGAHUA EARTHQUAKE

Source: Adams R.D., Eiby G.A., Lowry M.A. in B.O.T.N.Z.N.S.F.E.E. Vol 1 1969:18

MAP VII: FELT OBSERVATIONS AND ISOSEISMALS FOR THE MAIN INANGAHUA EARTHQUAKE

Source: Adams R.D., Eiby G.A., Lowry M.A. in B.O.T.N.Z.N.S.F.E.E. Vol 1 1969:17



Felt observations and isoseismals for main Inangahua earthquake.

May 24

ORIGIN TIME	1968 May 23 17 hours 24 minutes 16.7 seconds (Universal time) 1968 May 24, 5.24 a.m. (New Zealand Standard Time)
EPICENTRE	41 72' South 121 94' East
DEPTH	12 Kilometres
MAGNITUDE	(Richter) 7.0
INTENSITY	(Modified Mercalli) MM X
ORIGIN	15 Kilometres north of Inangahua

The epicentre of the earthquake was confined to the Oikaka or the Mackley River Valley, a few miles north of Inangahua township.

The first movement of the shock was an upward displacement. No longer than two seconds later the high frequency vibrating and confusion of noises enveloped Inangahua as the surrounding hills crashed down, trees were uprooted,dwellings destroyed and dislodged off their pilings and roads ripped up. Then came the jolting as shock waves started to rebound through the region (Hogue 1969:37).

The duration of strong shaking at Inangahua is difficult to estimate, but it was probably rather less than a minute[1]. It would seem much longer to someone actually experiencing it:

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[1]Private communication W.D. Smith, Seismological Observatory.

one respondent stated that it lasted for one and a half minutes.[1] Another respondent stated that it was only a few seconds after the initial shock that the aftershocks began[2].

Inhabitants of the sleeping town and the surrounding region were awakened immediately. One respondent's first conscious thoughts on the Friday morning were

> "Being violently wakened by an upthrust, the house seemingly took off, then settled into a violent shaking movement. There was a tremendous noise, which afterwards would be the ground noises from the earthquake, the crashing of furniture and crockery in the house, and the hills disintegrating. Having experienced other earthquakes, but not of this intensity, I felt that this was the end".

Another homestead was heaving so much that Shirley, a farmer's wife, could hardly stay in bed. Nor could she get to her two small children in another bedroom. Her husband Dave, was getting the cows in for milking when the shock struck. The cows stampeded and ran over the top of him. In The Camp, another couple tried to stand up, could not, and were thrown from side to side in their bed. One couples bed was moving violently in all directions. While the earthquake was occurring "you couldn't do much about it". Another couple in the Junction also considered that there was not much point in doing anything: once they had identified what was happening as an earthquake, they decided to stay in bed. In New Creek, a farmer's wife could not answer her husband's question about what

[1] "Estimates of the time of duration of an earthquake made without a watch are often seriously in error, with a strong tendency toward overestimation. Shocks are known to have lasted from a few seconds to more than a minute, though in the case of long duration there are generally one or more lulls". (Heck 1965:7-8).

[2] The seismological bulletin that documented the earthquake sequences lists an aftershock of magnitude 5 just nine minutes after the main event. There could have been smaller ones preceding this one, but they would have been masked on the seismological records by the coda of the main event which, detectable only by sensitive seismographs, continued for quite some time (private communication W.D.Smith).

was happening, she had lost her voice from fright. The house seemed to lift and tip over to one side and back again. This sensation of houses tipping was also recalled by another respondent. He thought his house was sliding down a huge hole.

The Primary Impact of an earthquake is the physical damage and the injury wrought by the tremors as they proceed to convulse the surrounding environment. Certain other types of hazards that are concommitant with earthquakes, such as fires and electrocution from fallen live wires, are indirect effects and are considered secondary impacts. Landslides consequent upon earthquakes acting as a trigger are also termed secondary impacts according to White and Haas (1977:322)(refer Figure 12). In the Inangahua earthquake two deaths were directly attributed to landslides and an unknown amount of physical damage, particularly to communication networks, was caused by landslides. The difficulty of differentiating the effects of primary and secondary impacts are problematic and will not be developed here.

Loss of life and injury was relatively light[1], with 17 people injured and three deaths as a direct result of primary and secondary impacts (a taxi-driver whose vehicle crashed into a bridge as a result of the road subsiding before the bridge approach; one woman who was engulfed in a landslide; and another woman who died in hospital after being caught in a landslide). Three more people died indirectly as a result of a

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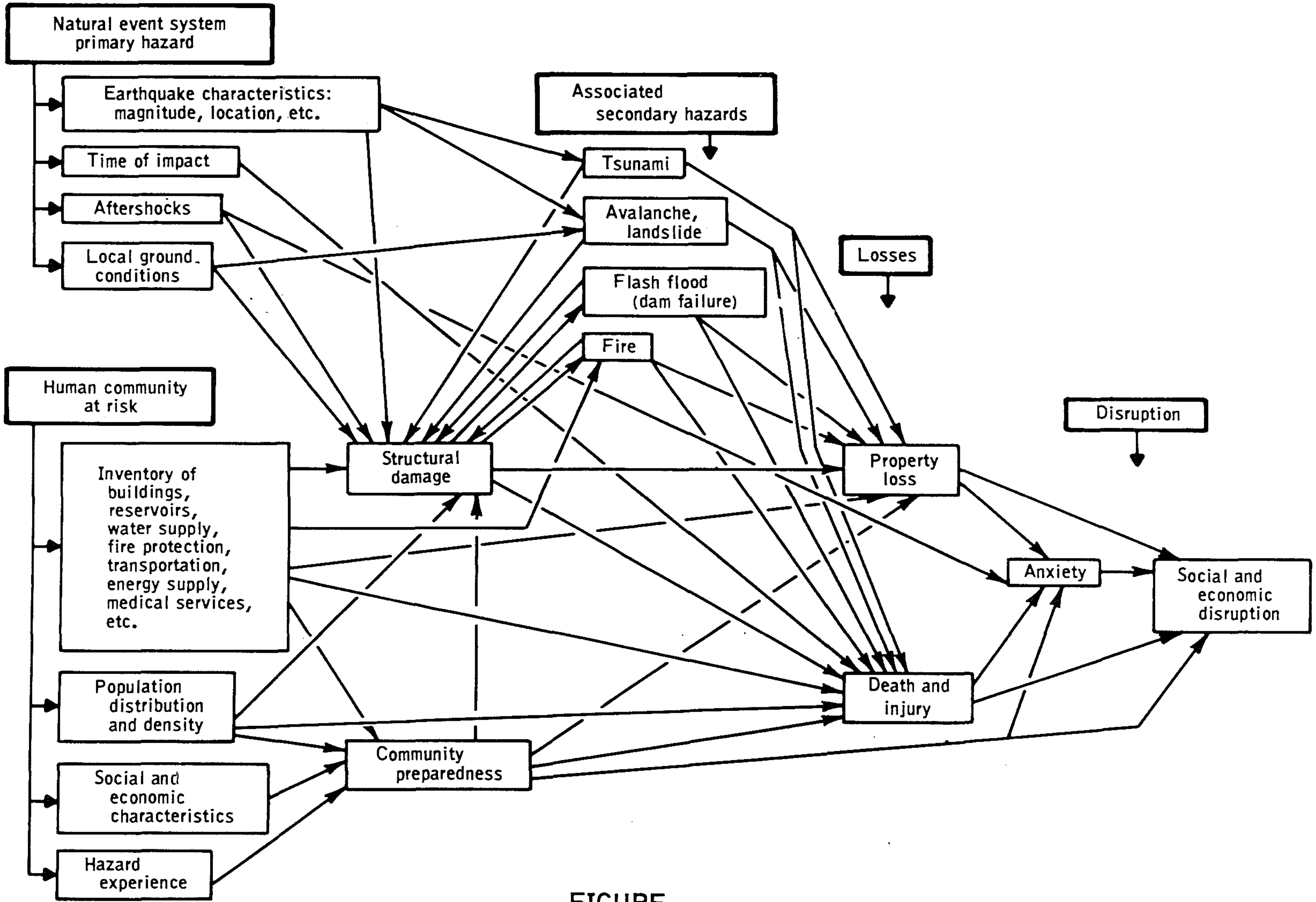
[1] The percentage of deaths by population numbers in the impact area was 0.6%, the percentage of injured was 5.6%.



FIGURE

SOME RELATIONSHIPS OF THE IMPACT OF EARTHQUAKES
ON HUMAN SOCIAL SYSTEMS

FIGURE 12: SOME RELATIONSHIPS OF THE IMPACT OF EARTHQUAKES ON HUMAN SOCIAL SYSTEMS

Source: White G.F. & Haas J.E ASSESSMENT OF RESEARCH ON NATURAL HAZARDS (M.I.T.Press) 1975:322

helicopter accident while linesmen were repairing power cables in the 'recovery period'.

Within the impact area, without exception, every property-owner suffered damage. The particular location of the earthquake (near ground level almost in the centre of Inangahua township) caused destructive damage to buildings, roads, railways, bridges, as well as initiating many slips, slumps and rock falls throughout the Buller region (refer photographs). Some indication of the damage caused by the earthquake may be gained from estimates of expenditure incurred by the following Government Departments.

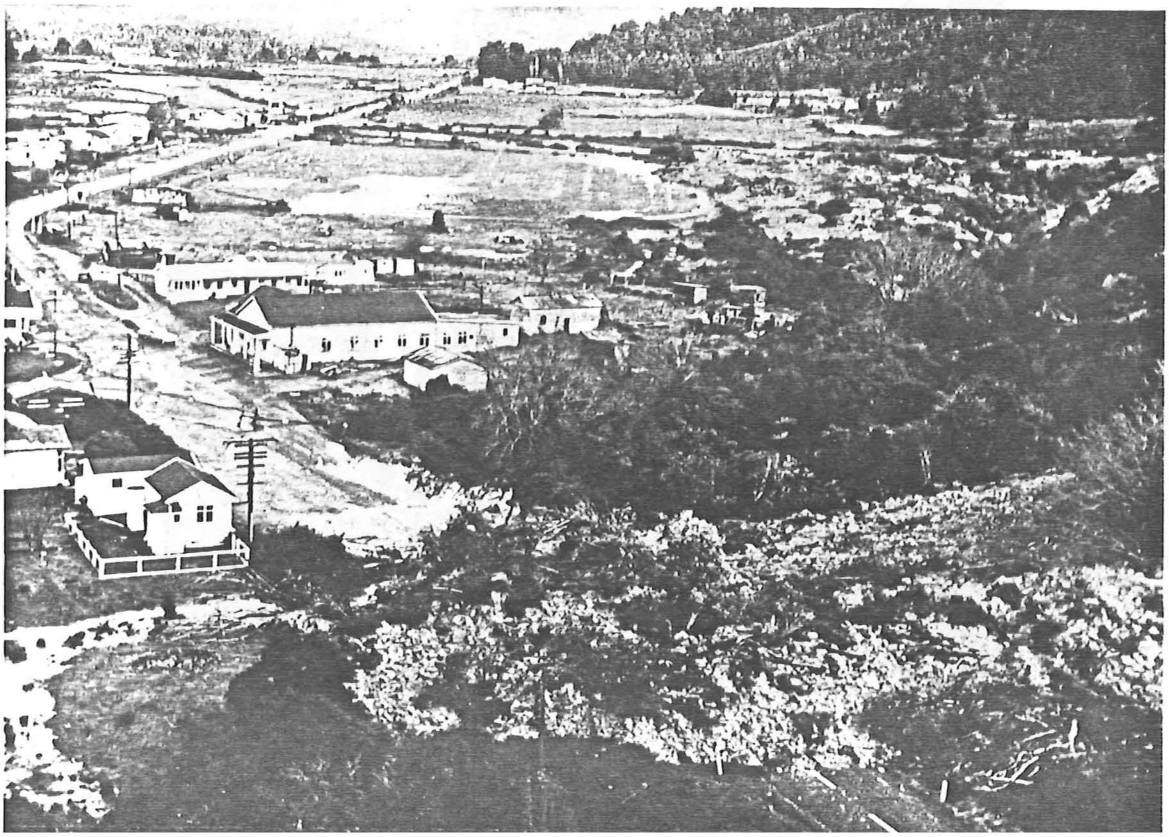
		$ NZ
N.Z. Railways	Restoration of rails, buildings and bridges	424,516
National Roads Board		515,000
Education Department	Repairs to school	121,000
Electricity Department	Repairs to towers, switchgear and buildings	77,332
Internal Affairs Department	Civil Defence costs	24,156
State Advances Corporation		53,300
Miscellaneous		19,400
	TOTAL	$NZ 1,234,704

In addition, the New Zealand Earthquake and War Damage Commission paid out $2,500,000 on 10,500 claims from the earthquake[1,2].

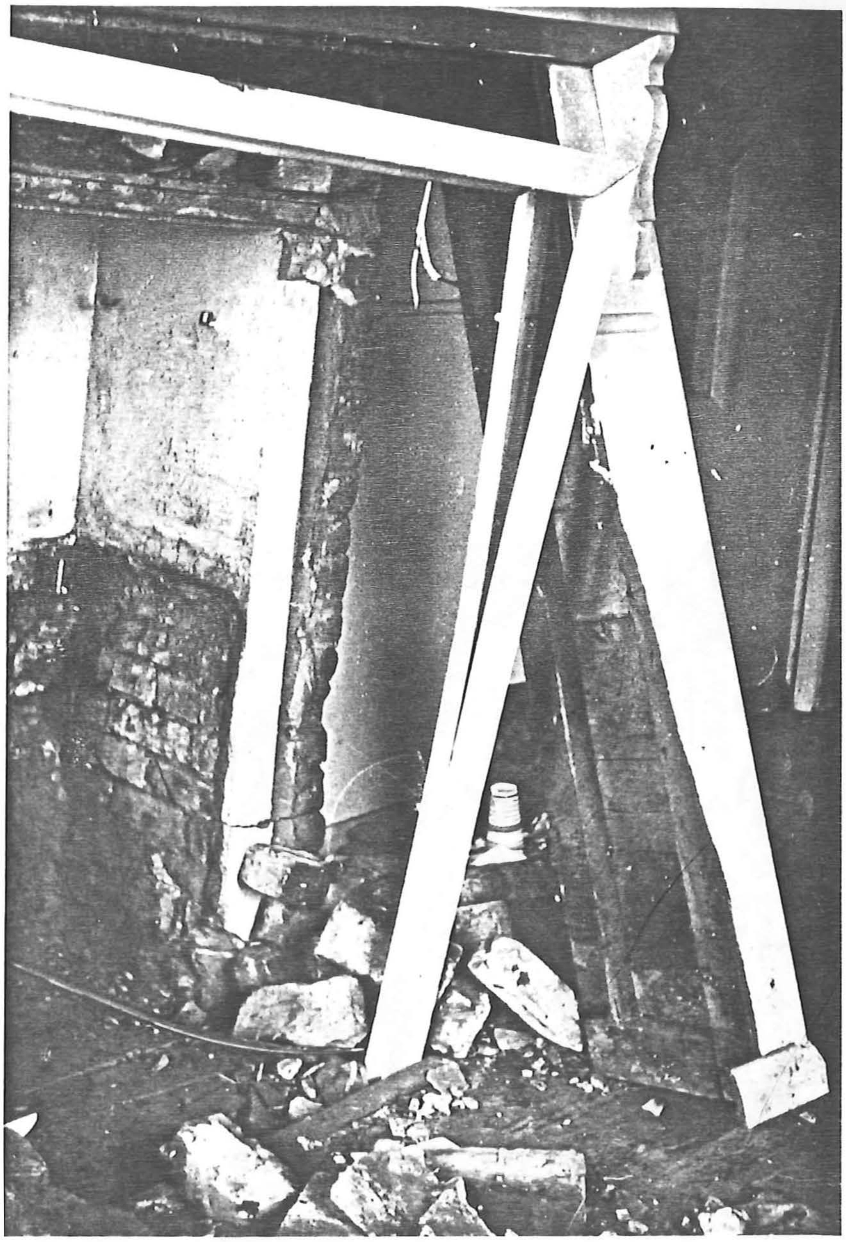
[1] Report of the Earthquake and War Damage Commission for the Year Ending 31 March 1969 (Government Printer, Wellington 1969:3).

[2] Although the Report of the Earthquake and War Damage Commission for the Year Ending 31 March 1969 does not specify where the earthquake claims come from, a suspicion is that the greater number of these claims were from the West Coast (South Island) region.

Inangahua Junction. The main street split by a fissure. Note the collapsed chimney on the house in the left of the photograph, and the fallen telegraph pole



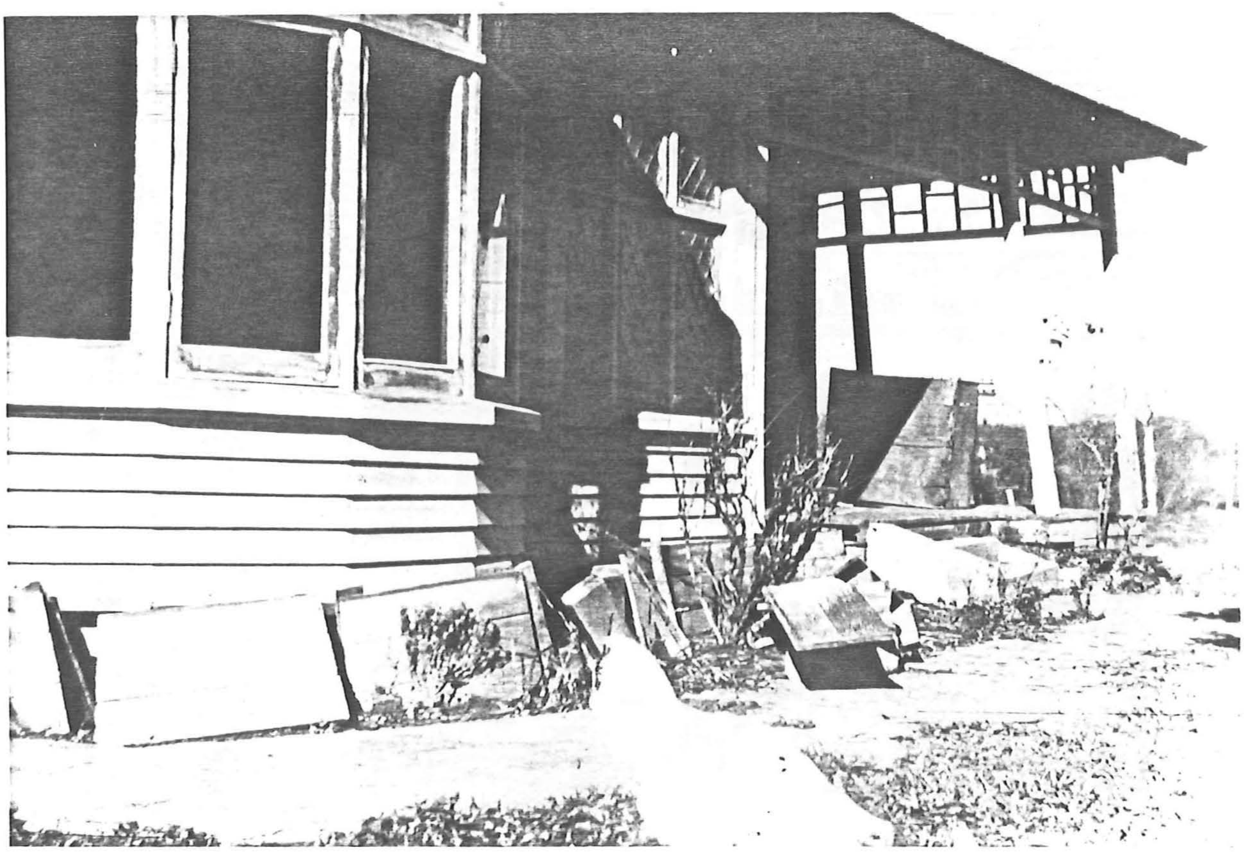
A large landslide poised above Inangahua Junction which threatened the buildings as it continued to move towards the settlement



Damage to the interior of
a house in Inangahua Camp

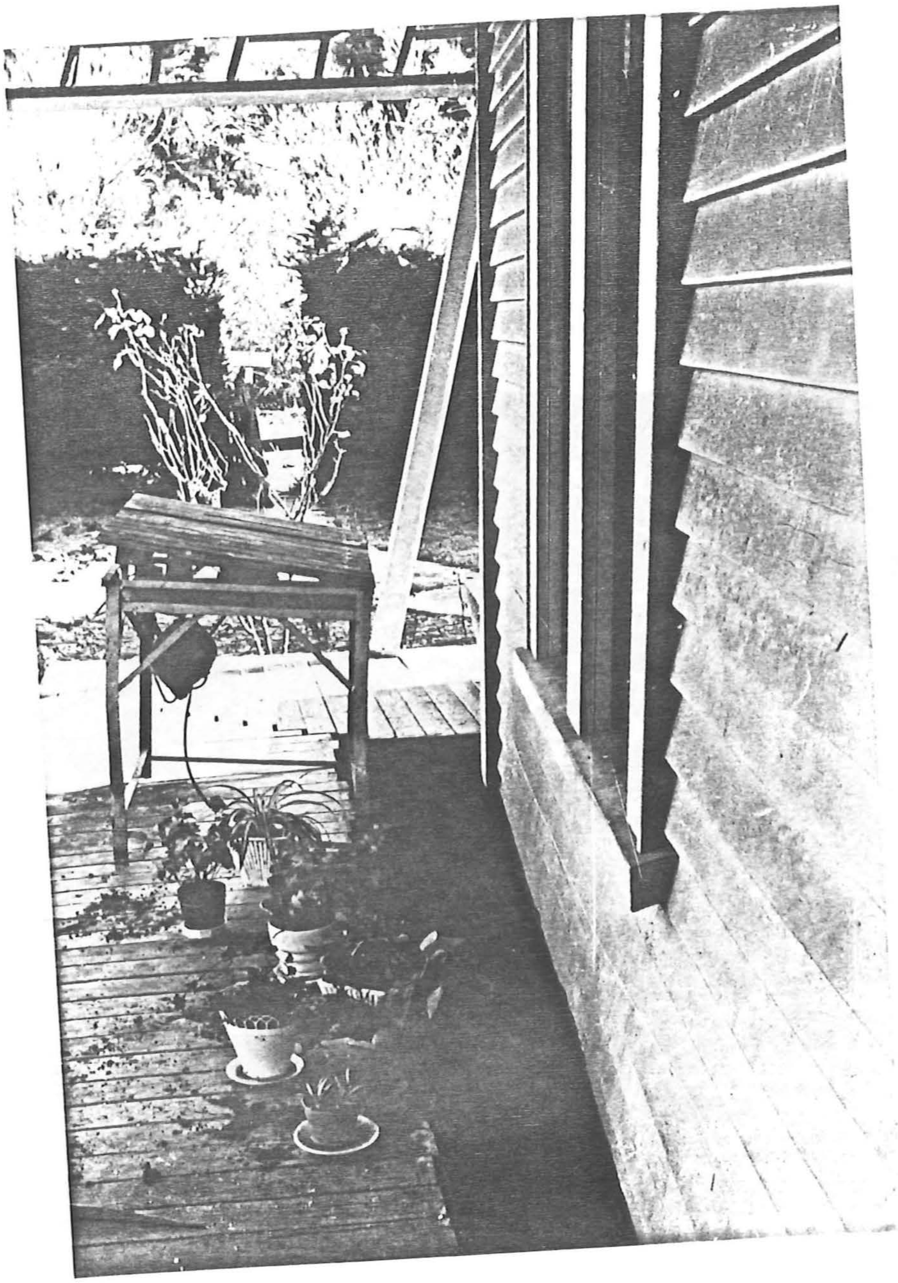
The damage sustained by the earthquake
in a house at Inangahua Junction

House at Inangahua Junction
illustrating the external
structural damage as a result
of the 1968 earthquake.

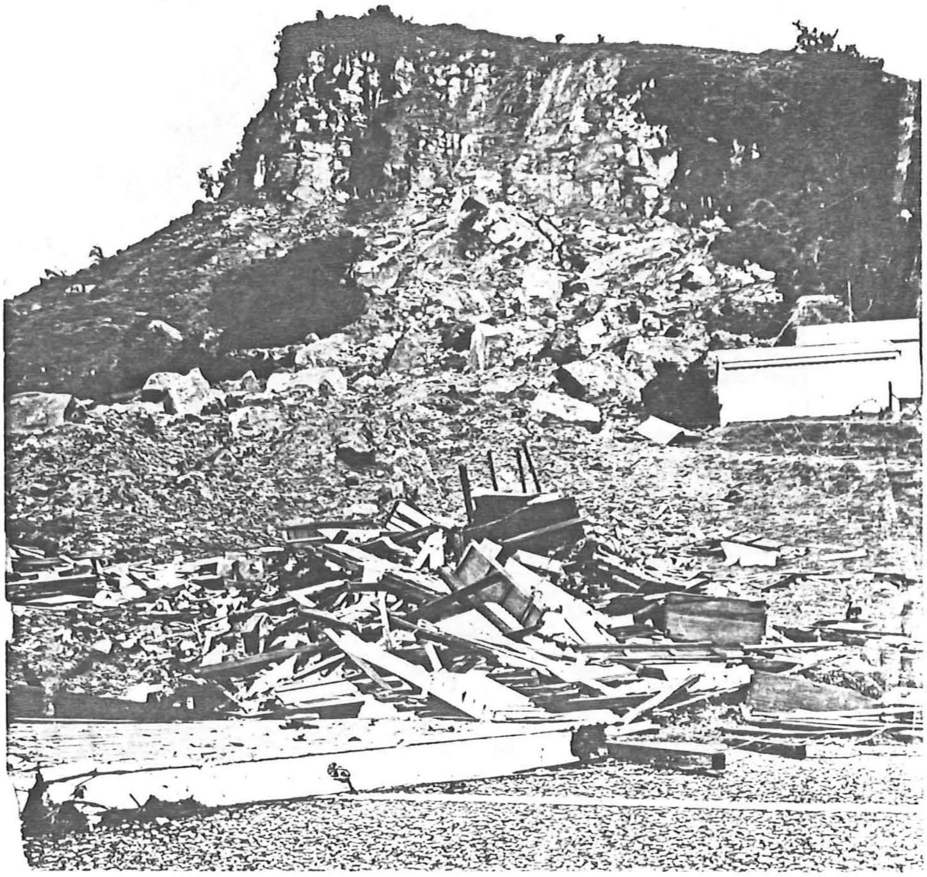


A further view of the house at Inangahua Junction (refer page 156).

House at Inangahua Hydro Camp showing the damage to tiled roof and chimney.

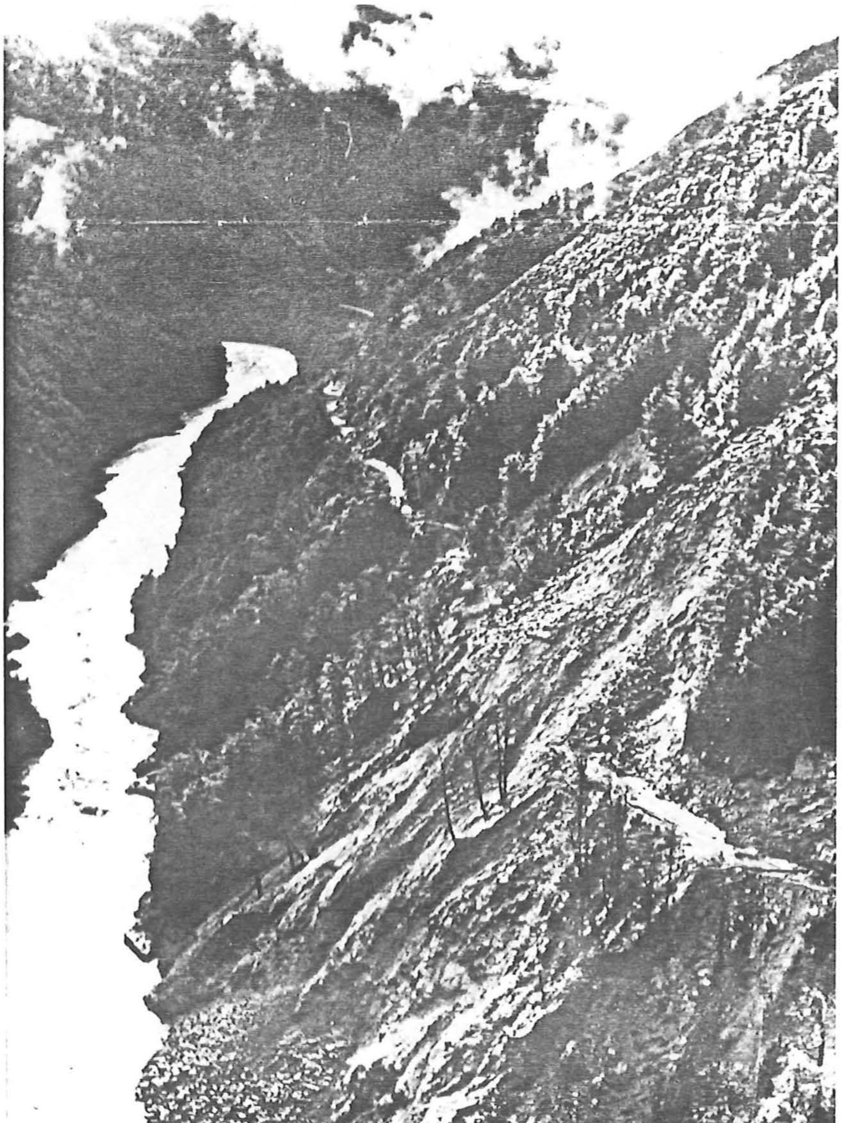


House at Inangahua Junction
illustrating the movement of
the house on the foundations.
Note the gap between the verandah
and the house.

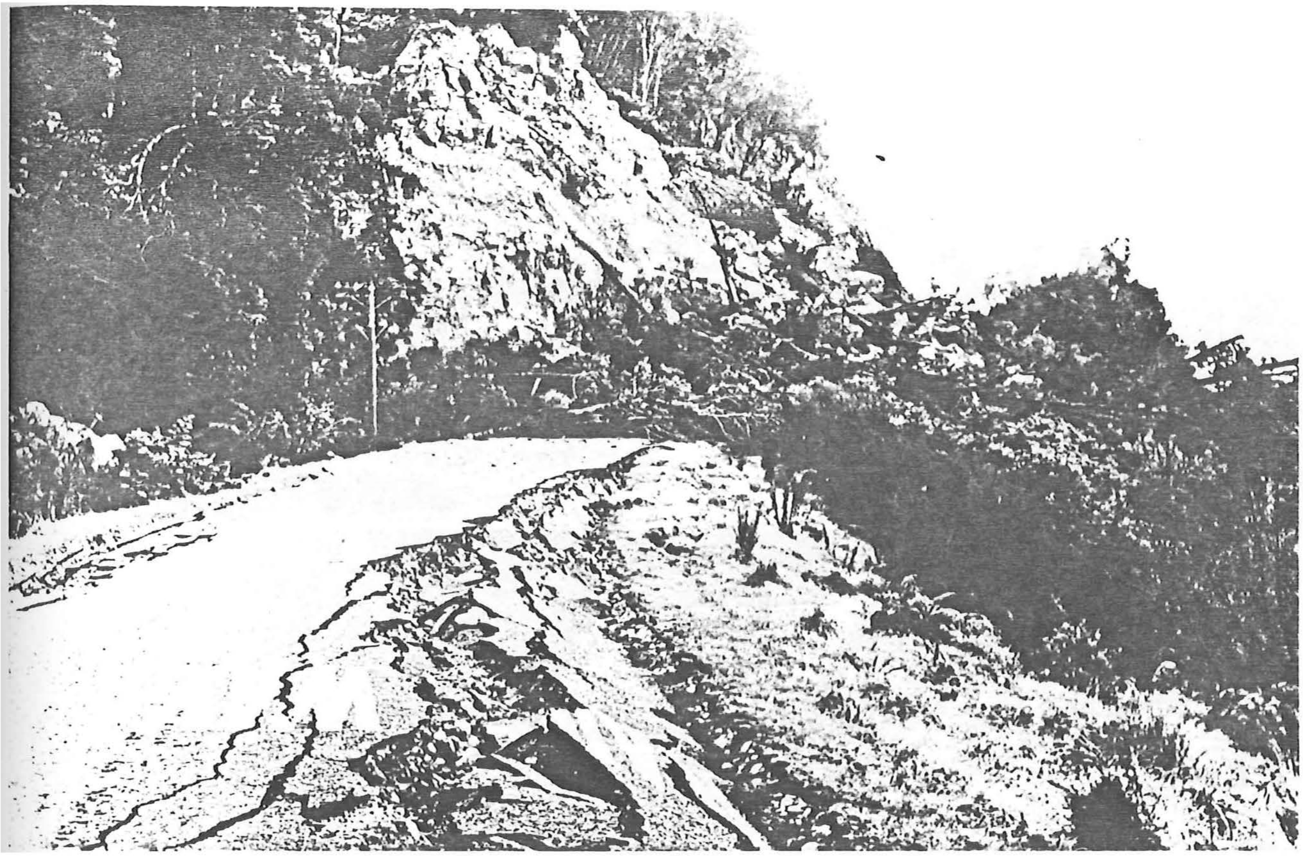


Remains of a house which was swept
150 yards by a landslide. One person
was killed in this landslide and another
occupant of the house died from injuries
later in hospital

Twisted railway lines leading into
Inangahua



The main highway through the
Buller Gorge obliterated by a
landslide



Road blocked by landslide at Oweka

Road subsidence. The driver of this
car pulled out of his driveway in the
pre-dawn light and backed into this
hole created by the earthquake.

The road between Reefton and Inangahua
showing subsidence.

Road surfaces buckled under the energy
released by the earthquake.

(Photographs by courtesy of the Christchurch 'Press', the Christchurch 'Star', the Greymouth Evening Star, and residents of Inangahua Junction).

Severe damage to dwellings, on the basis of the initial field damage reconnaissance by Shephard et al (1970) appeared to be confined to an area from Stitts Bluff (Berlins) and Inangahua Landing, to Inangahua Junction to Lyell (an area of 216 square kilometres). As a result of the earthquake, eighteen buildings were recommended to be 'written off' in Inangahua because of their condition.

In Inangahua and its immediate environment, all chimneys appeared to have been damaged. An incomplete assessment two days after the earthquake revealed that 70 per cent of 80 house chimneys (56 houses) in the area had totally collapsed. Those that had not collapsed were badly cracked. By June 19, 1968, the official assessment was 3,842 chimneys in need of repair in the West Coast region. After a more thorough investigation carried out by July 24, 1968 the number had risen to 5,000 requiring repair.

For a distance of about 40 kilometres south of Inangahua and through the Upper and Lower Buller Gorges roads were seriously affected by slips, cracks and subsidences. All the State Highways and the County roads into Inangahua were blocked by extensive slips. Cracks in sealed roads were very prevalent. Over a wide area road fills subsided, particularly bridge approaches. Within 40 kilometres of Inangahua, 30 of the 50 bridges examined showed displacement or damage (Evans, 1969). There was damage to culverts, as evidenced later by gradual subsidence of the road surface caused by fill material dropping through gaps between displaced pipes. The major damage to State Highways (S.H.) was centred at Inangahua Junction and extending on S.H.6 from about Eight Mile Creek in the Upper Buller Gorge to Windy Point in the Lower Buller Gorge, and on to S.H.69 from Inangahua Junction to Cronadun. On S.H.67 there was extensive cracking and deformation of the sealed surface between Westport and Mokihinui and several large landslides on the Karamea Bluff section. On S.H.7 there were some more slumps and dropouts; on S.H.6 there were a number of landslides. Opposite the foot of Dublin Terrace, on the south side of the Buller River, a large rock and rubble avalanche swept over 600 metres into the Buller River and about 110 metres up the opposite bank to dam the Buller River to a height of between 18-25 metres above normal. The Buller River was backed up for about seven kilometres, but early on May 25 the water broke over the top of the avalanche and gradually cut down the dam without causing any serious flooding to the lower reaches.

In the Whitecliffs area the high bluffs of limestone overlying papa were badly shattered and large landslides wrecked a bridge and substantially covered a highway. It was necessary to abandon the highway over this section and relocate a new road in the river bed clear of the unstable cliffs and wet slips.

The total assessed quantity of slip material that had to be cleared from highways as a result of the earthquake exceeded 400,000 cubic yards.

Damage to railway facilities was mainly confined to a 30 kilometre radius of Inangahua. Sides gave way and slip material covered the track. In some places the track had to be rebuilt after the slips had been cleared. Embankments subsided or slipped away leaving the lines suspended. The track was pushed out of line for practically the whole 90 kilometres length of the main affected area.

In the New Zealand Electricity Department substation building, at Inangahua Junction, the station battery, the control relay and communication panels were overturned. Three 66Kv insulator stacks in the airbreak switches were snapped off (Hitchcock 1969). The six Departmental houses and the depot buildings were severely shaken and damaged. The telephone exchange at the Junction was twisted on its foundation and, owing to extensive damage to the lines, no telephones were working. Outside contact was lost because of toll line damage. Three kilometres of underground cabling was abandoned in the Junction area as the cable was badly damaged by 80 ground subsidences and cracks. The Post Office and exchange building were threatened by a large slip, and the buildings were relocated to a new site (by June 9, 1968). The Reefton Post Office was badly damaged and had to be demolished on June 5, 1968. Minor damage occurred in the Greymouth exchange building. Major damage to Post Office plant and lines occurred in the Upper Buller Gorge due to slips immediately following the earthquake and further slips due to heavy rain in the area after May 24, 1968.

In Greymouth, the Fire Station was evacuated because of the condition of the building, as was one of the hospital wards. In Westport the water and power supplies were disengaged by the shock, and sewage lines broke. There was no water for a period, and low pressure was experienced for a time. A building had to be demolished as a result of the earthquake. Gas mains were severely affected.

The time during the initial tremor was, for most people, a time of bewilderment. Immediately after the main earthquake there was a period of considerable activity by the residents. One of the residents, Terry, said that his first thoughts were to get to his son: "How I got there I don't know, looking back, but I arrived there in the bedroom". When he got there his son was sitting up in bed shouting: "Daddy, Daddy, the house is falling down!" Terry picked him up when he managed to catch up with the bed as it scurried across the room and got themselves back to the main bedroom, by which time the initial intensity of the shock was decreasing. Another couple tried to get up and out of bed, but the combination of a duchess mirror falling over their legs and the motion of the earthquake meant that they were thrown from one side of the bed to the other and could not get out of their bed until the earthquake had stopped. "People seemed to become 200 per cent alert at a time like that", said one respondent, recalling the time.

"When it happened, I just could not imagine getting out alive". This sentiment was expressed by 58 percent of the respondents. Others were "frozen, just frozen to the spot".

The impact caught everyone unaware, and impressions were mixed as to what was happening: some guessed it was an earthquake immediately, others thought it was a cyclone, a bomb, a bull-dozer ramming their house, war, or just "the end of the world". With the almost immediate swaying and rolling of the ground and the houses after the initial upthrust displacement, the residents soon realized that what they were experiencing was an earthquake. The noise was tremendous as if, according to one respondent, "a train was hurtling along right next to you".

What happened during the initial impact is rather confused: some reported that while the main earthquake event was in progress they were in the act of rescuing and securing their children. Others claim that any activity during that particular earthquake would have been impossible; it was only possible to "hang on and try to stay where you were". One must also remember that the main earth tremor lasted for a period of less than a minute and the next recorded aftershock (Richter 5) was nine minutes later (at 5.33 a.m.). This does not mean that there was no earthquake activity within that nine minute interval; if there were any they would have been masked by the seismological recordings of the main event and thus were not recorded as separate tremors. The activities which some of the respondents stated they undertook during the initial tremor would, in all likelihood, have been impossible to achieve. This activity could have been achieved within the interval between 5.24 a.m. and 5.33 a.m.

There are three possible explanations which could account for this discrepancy of the respondents'statements. The first is that at the time of the earthquake and for a short period after the main event, the respondents were confused and bewildered. They may not have had any cognizance of the period of relative quiescence between the main shock and the first aftershock. In all the jumble and mess of their disarranged homes, it could have seemed that they rescued their children during the main event, but in actuality they may have rescued their children <u>after</u> the main tremor, <u>during</u> the period of quiescence and <u>during</u> the first aftershock. Because of the confusion, this period was condensed in the participants mind as being undertaken in the main event.

The second possibility relates to the passage of time between the earthquake in 1968 and the time of interviewing in 1978. The ten-year gap may be too long for the respondent to recall all chronological events with complete accuracy. Third, the respondents may be rationalizing the situation when they stated they rescued their children during the main earthquake. This makes their action more acceptable to themselves and to others (it is more appropriate for a parent to save his/her child(ren) in times of crisis than to do nothing). It may be the case that these respondents have internalized the <u>ideal</u> behaviour in favour of their real behaviour; ideally, this assumption suggests, they should have rescued their children as soon as a dangerous situation manifested itself.

In reality, they may not have been able to do anything (no one could have realistically done anything substantial during the passage of the main earthquake). Feelings of guilt, generated by their inaction, or feelings of inappropriate behaviour by not doing anything may have made the respondent subconsciously reject the real and accept the ideal as their actual behaviour.

There is a fourth possibility, and that is a combination of all or any of the above.

5.3.4 Inventory

Wallace defines inventory as that period which enables the disaster victim to develop a perceptual and cognitive reorientation to the new environment so that a decision on action is possible (1956:10). Inventory is, to a large extent, an individual orientation, and the length of time taken in inventory is probably highly variable from person to person. Inventory is the period of stocktaking; it is the period before organized, concerted action from within the impacted community becomes apparent. Individual inventory moves into collective inventory of what has happened and the recognition of what to do next develops. The inventory phase can be considered to consist of two separate and distinct parts; the first is that period described above, that centres on the impacted community. The second part, which is very relevant to this particular earthquake situation, is the inventory conditions that occur external to the impacted area. Stocktaking and 'reorientation' need not be confined only to the zone in which the disaster occurs. Authorities and communities outside the impacted area also need to prepare themselves for future rescue and relief work. A collective inventory of what has happened in the impact zone has to be achieved in those areas peripheral to the impact zone because it is these external areas that predominate in the rescue, relief and recovery of the disaster area. If the area of impact has sustained a disaster, then, by definition that area is incapable of recovering fully from the devastation through the institutionalized means that were available to that area before impact. The impact area is then dependent on regions external to it for full recovery and relief rescue work. At the same time, the dependency between the impact area and the external regions relies on the ability of the external regions to be aware that disaster has occurred. Thus the inventory period could be considered as an 'Awareness Phase' on the part of authorities outside the devastated region.

In the 1968 earthquake there was considerable confusion as to where the epicentre of the earthquake was. External authorities had to first establish the whereabouts of the impact area before coming to an understanding of what they should do to alleviate the damage and injuries that were consequences of the earthquake, or even if they were required. Consequently, the period of Inventory that Powell and Rayner describe will be subdivided into the "Inventory Phase" which will examine the variables pertinent to the inhabitants of Inangahua, and the "Awareness Phase" which will centre on the situation and activities external to the impact area.

(1) The Inventory Phase

Inventory begins the moment the primary impact ceases. This creates a problem when discussing earthquakes because major earthquakes seldom end with one tremor[1]. Aftershocks can occur for many days, weeks or even months following the main event and can cause further damage and injury (hence Powell's type III disaster-type, i.e. "prolonged repetitive impact-series with cumulative threat" (1954:II,16). This 'prolonged' impact has many implications regarding the behaviour of people in the disaster area, both as individuals and as members of a collectivity. This situation may be modified in the case of earthquakes by the somewhat mistaken belief[2] that after the initial earthquake all subsequent earth shocks will 'not be anywhere near the size of the first one'. So, although the earthquake series may involve a repeated number of shocks, for the victims perception of the earthquake, a 'cut-off point' can be located between the main shock and subsequent aftershocks.

This idea that all subsequent tremors after the initial shock will not be as large or as damaging provides the researcher with the convenient 'cut off point' as well. Although the

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[1] Private communication with Mr. George Eiby, Superintendent of the Seismological Observatory, D.S.I.R., 11.6.79.

[2] As George Eiby points out: "The main shock could be a fore-shock of a larger event. Aftershocks may also be large in terms of magnitude, but according to the empirical Baths Law, the largest aftershock is 1.2 magnitudes smaller than the main shock, although the variations of these are wide. Also, there is no reason why the last aftershock in a series should/could not be the largest, as was the case in the 1931 Hawkes Bay sequence. The largest aftershock in this sequence came ten days after the initial shock". (private communication)

Inangahua region "was like a jelly all day",[1] the main damage was sustained by the initial jolt and the immediate subsequent shaking, plus the effects of the landslides that resulted from the ground movements. If the residents of Inangahua were not immediately aware that it was an earthquake, they were by the time the first tremor had subsided. The acknowledgement of this event was the beginning of the inventory period. After recognition of the cause of disruption, stocktaking could begin.[2]

Some people were in a state of disbelief over what had happened and what had caused the destruction. This was particularly evident from the older inhabitants of the region. After the 1929 (Murchison) earthquake, it was popularly believed that there would be no more earthquakes. When another earthquake struck with similar destructive force it was therefore not expected and the older inhabitants were really taken by surprise.

One respondent thought that the earthquake had caused considerable destruction throughout the country: when his eight year old son asked him if there was going to be any people dead, he answered: "Yes there would be a lot of people dead this morning". Many inhabitants of the Inangahua region

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[1] Over 809 earthquakes were recorded within 40 days of the initial shock (Adams et al 1971:5).

[2] Stocktaking and reorientation could not begin if the cause of the disruption or devastation was not known. If the cause was not recognisable the situation would revert to that of the threat phase because the people in the impact area would not know if the disaster agent had ended or not. With the belief that earthquakes create damage only in the initial shock, the people were then able to organise themselves and take stock of the situation.

thought that the earthquake must have caused immense damage in other parts of the country. Of the 24 respondents who were living in the Inangahua region at the time of the 1968 earthquake, 17 (70.8%) spontaneously recalled that they thought other areas of the country were worse hit than their own township. In Westport, the Anglican vicar's house was situated on the road that led to the Westport hospital. The vicar thought the earthquake must have been very severe because there seemed to be a lot of traffic passing his house which he thought was taking the dead, dying and injured to the hospital. He told his wife he was going to the hospital to see if he could be of assistance.

The period after the earthquake is relatively difficult to reconstruct because outside observers who would be in a better position than the victims to deliver an objective assessment of the victims activities had not arrived into the impact area. Those in the area were not always in the best position or frame of mind to observe objectively, or to remember without distortion later, what they did. A generalised reconstruction from the comments made by inhabitants of Inangahua and the surrounding farming area suggests a scene like this:

Twenty of the 24 respondents (83%) had children in the house at the time of the earthquake. All those 20 respondents, except one, either went to their children's rooms to rescue them, or called out to their children to see if they were alright and safe. What happened next is universal amongst the sample population with families (50%). The children were collected and brought back to the main bedroom with the parents (25% of the respondents), or evacuation of the house was undertaken immediately (25% of the respondents with families). Those families who first gathered in the main bedroom later moved outside the house. All were outside their houses by daybreak. Uniting family members in some cases involved considerable physical feats (moving 22 cubic foot freezers out of doorways; pushing against jammed and blocked doors; uplifting furniture from beds; climbing out of windows). All these activities were undertaken in the dark in houses that had been disrupted by the effect of the earthquake. The immediate actions undertaken centred around getting to safety and security.

To better understand the actions of the impact-victims after the earthquake, a knowledge of the composition of the disaster community is required. The concept of community has been the concern of sociologists for a long time, and the definition of community has proved to be problematic (refer Hillery 1955; Bell and Newby 1971, 1976; Kilmartin and Thorns 1978; Thorns 1979). Thorns states that the study of any aspect of society has two major dimensions, those of structure and meaning (1979:26). There may be a difference in interpretation of what community is, based on these two dimensions. Very generally, the idea of community on a structural dimension implies that community can be observed as a 'geographical expression, that is, a finite and bounded physical location' (Bell and Newby 1976:195). The community in this perspective can be viewed as a single unit, the concern being with the 'size, density, growth and economic organization and regularities' (Thorns 1979:26), that are found within a bounded locality.

On the other hand, the "meaning" dimension has the idea of community focussed on the social construction of the members in that society and 'is part of their search for social identity' (Kilmartin and Thorns 1976:141-142). This 'meaning' dimension orientates the researcher to the belief that a community may be composed of not one identifiable community, but a number of 'sub-communities' with separate identities. Each of these sub-communities are interlocked to provide a distinct geographical area, or a 'bounded physical locality'.

Any populated area may be divided into subcommunities based not only on the meaning dimension, but on territorially or geographically-created units. These territorially distinct areas may still be considered a community of sentiment (after Toennies 1957). This was the case in Inangahua after the earthquake in 1968.

Inangahua was composed of three geographically distinct areas, yet these areas were combined socially to form one united community in terms of the residents' social construction of the township. The three areas were Inangahua Junction, Inangahua Camp, and the immediate hinterland comprising approximately 30 farm houses. The earthquake produced a restructuring of the Inangahua community into three distinct territorial units, whereupon the community of sentiment which had characterised the three areas before impact was temporarily eliminated.

The actions of the residents after the earthquake are dependent to a large extent on the location of these victims in relation to the township. Taking the areas of the Junction, the Camp, and the farming homesteads separately, and elaborating on the generalized activities that were undertaken within these three areas, a better understanding of the reactions and the behaviour of the impact-population can be obtained.

In the Junction, which had a 1968 population of about 40 people, the residents started to gather outside the Junction Hotel immediately after the first series of earthquake impacts. Nobody was injured by the earthquake, but everyone seemed to be in a shocked and confused state. The majority of the Junction residents were in their night attire. Nobody, it seems, thought of checking the houses to see if anyone was trapped or hurt. Most assumed by the number of people congregating outside the Hotel that all were present. According to one respondent, the Junction population "stood around talking, discussing what had happened". Another respondent was more explicit: "They were all standing in the middle of the road passing round whisky and brandy, drinking it neat, passing it round and round". People comforted each other, warmed each other by offering them blankets that they had grabbed as they ran out of their houses. People were quiet and companionable. Everyone was in groups, and as people came to an understanding of what had happened, it became evident that they had all suffered a similar experience, a narrow escape from falling debris, confusion, fright and bewilderment. They started to build up a picture of what had happened. "Everyone was recalling their individual experiences and what had happened to them. They (the experiences) were totally inconsequential things". People started to think about how others were in the Camp, friends and relatives on the farms, and further afield. Thoughts were turned to wondering how severe the earthquake had been elsewhere; where was the centre and what was it like there? "That was something everybody was thinking about". It did not occur to anyone in the Junction that the epicentre was almost where their township was. It was not until daylight - an hour and a half later, that people began to realize that they were the centre of the earthquake. The Greymouth radio station's seven o'clock news broadcast recorded the fact that Greymouth had been rocked by an earthquake in the early hours of the morning but the damaged sustained was, on the whole, superficial.[1]

For that first hour and a half until daylight at seven o'clock, little occurred apart from piecemeal conversation between congregated inhabitants. "Its a funny feeling because you don't do anything. You just stand there and occasionally you talk to someone. Nobody was doing anything at all".

[1]Greymouth was not declared a disaster area. The earthquake disrupted electricity, water, gas and sewage systems. Structural damage to buildings, although some had to be demolished afterwards (Greymouth had a lot of masonry-type buildings), was in the majority of cases confined to falling chimneys and wall cracks. There were no injuries recorded. Earthquake and War Damage assessors established an office in the city for the 2,000+ claims ultimately received. A Reconstruction Committee was also established in Greymouth.

With daybreak came the realization that they were in fact the centre of the earthquake. Associated with daybreak was the ability to look, for the first time, at the damage caused by the earthquake. People started to venture forth, to look at their homes. "Everyone seemed to want to go off and have a look at the damage to their homes". People were not keen to go inside their houses; some rushed inside to get extra clothing and blankets, or food, some started cooking some breakfast out in the open. Others, particularly the farmers, started their routine farm jobs that had to be carried out no matter what the circumstances, feeding and milking stock. There was no attempt to organise the activities of the residents, each family went off and did what it decided to do, with no collective decision made on what should be done to alleviate their situation.

No-one attempted to clean up the debris. The earthquakes continued throughout the day, moving slips closer to houses, creating more uncertainty. About mid-morning word came through that there had been an accident up the Buller Gorge. A farmer's wife was missing after their house had been swept away by a landslide.[1] Some of the adult males made their way across the landslips and cracks in the road to assist in the search for the missing woman. The rest of the Junction residents meanwhile remained in an unorganized state until the return of the men, approximately at 3.00p.m., after the body was found under the rubble.

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[1] According to one source, this news reached the Junction by one of the Camp youths who had crossed the Inangahua Road Bridge.

Throughout this period of the disaster, there was no organised activity. There was no co-ordination between individuals and between other family members.[1]

The Camp had approximately 200 people living in it at the time of the earthquake. This section of the township can be divided into two, the State Hydro, or Electricity Camp, and the Ministry of Works (M.O.W.) Camp. Following from the earthquake, after the individual families had been united, the general activity was one of movement towards one of the two Camps.[2]

There seems to be four explanations why people congregated at the Hydro Camp:

1) Some went to the Hydro Camp because they had relatives living in the compound.

2) Others went to the Hydro Camp because of their job affiliation to that site.

3) Others went to the Hydro Camp because they were drawn by the blare of the alarm-hooter resounding above the crash of hills and falling trees.

4) Others were invited by friends and neighbours who were going to the Hydro Camp.

Similar circumstances drew people to the M.O.W. Camp:

1) The officer in charge of the MOW Camp had turned on the vehicle lights which flooded the Yard with light. This attracted many residents to the Yard.

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[1] The Reefton Police Constable stated that when he and the Superintendent of the Reefton Hospital arrived at the Junction around mid-afternoon, they came across people congregated around fires and barbeques.

[2] Some people stayed in or around their houses until daybreak and then moved to either of the two Camps.

2) Others went to this site because of job affiliation, relatives or friends.

3) Others were directed to the MOW camp by the officer-in-charge and his men.

The two Camps differed in the way that key personnel reacted to the situation that was now confronting them. In the MOW Camp, the Officer-in-Charge, dressed and called out to two employees living on either side of him. After making sure of the safety of the two employees families, one of the neighbours, together with a single man employed by the Ministry of Works "immediately set out to search the Inangahua Camp area. We had established within ten minutes to a quarter of an hour that there was nobody seriously hurt, that the destruction was quite severe in some houses and to a lesser extent in others".

People congregated together in the Yard and comforted each other whilst coming to some realization of what had happened. As the residents started to arrive at the Yard, it became apparent to the Officer-in-Charge and his assistants that something would have to be done to augment the welfare of the victims. So "we got some of the younger boys and the older men to build fires in the Yard". Thus by 6.30 a.m. a community fire had been started. Ministry of Works employees went round the houses and told the people who had not yet gathered at either Camp site that a relief centre had been established at the MOW Camp Yard and to go down there and take with them what they could in the way of food and cooking/ eating utensils.

At the Hydro Station, the Electricity Department employees were attracted to the Sation yard by the alarm hooter that had been activated by the earthquake. Realizing that this was upsetting the people[1], the Hydro Supervisor managed to pull the wires off the battery that fed power to the alarm and silenced it. The Station personnel started to look around the Camp and they soon realized that nothing could be done until daylight. They elected to go back to their houses with their families until they could restore the area in the light of day. For the next hour until dawn finally broke, the Hydro personnel comforted their families and their neighbours.[2] Some Inangahua Camp residents who had left their homes and had walked to the Hydro Camp sat in vehicles along the main road. Huddled in their vehicles, they sat until first light, wondering what had happened, what was still to happen, and wondering what was going on, experiencing as one respondent put it "the horrible feeling of everything crashing around us". At first light they saw the hills stripped of vegetation,houses holed and chimneys on the ground, water tanks upturned, gaping holes in the roads, trees and telegraph poles felled and leaning at odd angles. "We thought what was the rest of the place like if it was like this here". As daylight began, people started to move into the Hydro Camp site. The women and children started to prepare a fire and collected food that was strewn over the area from upturned freezers, and proceeded to "cook a bit of breakfast". While

[1]One respondent stated that "this alarm frightened people more than the actual earthquake." Another also commented on this effect.

[2]Some of the Hydro Camp population had joined other families in the compound and sought solace there.

some of the men also helped to get some breakfast ready, using an open gate for a barbeque grill, others were trying to restore the disrupted power supply at the substation.

The Farming Units are dispersed mainly along the river flats of the Inangahua, the Buller, the Mackley and New Creek Rivers. Scattered over these flats and valleys there were, in 1968, about 30 farmhouses.[1] They are usually located in pockets; the ones this research has focussed on were three farms up New Creek, three near Inangahua Landing-Browns Creek Road, and one up the Buller Gorge about three miles from the Junction heading towards Westport. A generalised reconstruction of the actions and behaviour of these people is as follows:

Of the seven representatives of the farming units interviewed, six had children living at home. The seventh had adult children living and farming next door to them. There was fright and bewilderment in the houses during those first few minutes, parents could not open jammed doors to their children's bedrooms, children were screaming out in terror, utterly confused because of the tremendous noise and heaving of the house. Most of the respondents had no idea that it was an earthquake in the initial moments. The first reaction of the parents, both during[2] and immediately after the first earthquake, was to rescue the children, and either gather them

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[1] There would have been approximately 50 people residing in these farmhouses.

[2] One of the residents claimed that they immediately woke up and gathered the children from their rooms and were at the back-door of the house when the initial shock subsided. This family was the closest to the epicentre.

together in the master-bedroom or immediately move outside. In the stillness after the first shaking the hills could be heard crashing down all around. Then the ground started heaving again. By this stage all had guessed that they were in the middle of an earthquake.

The next one and a half hours until daylight, a time of intense activity for some, the men checked property and indicated to their neighbours that they and their families were all right.[1] Until daylight, it was a time of stocktaking, coming to terms with what had happened, explaining to the children what earthquakes were and how they occurred, speculating on the extent of the earthquake and its destructiveness. By daylight the farming community had started to get themselves organized to aid themselves and their neighbours and to prepare for what they thought would be a very long period before outside help would arrive.

Chapman suggests that individuals are

> "...overwhelmed for the moment that only he and his immediate companions have been the victims".
>
> (1962:15)

Two statements can be made about this observation from Chapman with reference to the 1968 Inangahua earthquake situation. The first is that Chapman's observation is valid in the Inangahua situation if the person's 'immediate companions' are taken to be not only that person's immediate family, but all the people in

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[1]A dam had burst on one New Creek farm and the farmer and his farm-hand immediately went to assess the situation. The farmers on the Buller Gorge road drove their cars onto the road and turned on their headlights as a sign to each other that they were 'okay'.

the geographical area, or the sub-community, in which that person is a resident (i.e. the Camp, the Junction, or the farming areas). The second statement that can be made is that Chapman's observation does not seem to be relevant in the 1968 Inangahua disaster if one considers how many of the respondents spontaneously wondered how people and places outside their own sub-community had suffered, and where the epicentre actually was (70.8% of the respondents wondered this).

From all accounts, there does not seem to be any evidence, as obtained from the respondents of the Inangahua area, of any fragmentation of the disaster scene into isolated individuals, or any reactions of the kind that Wallace described as the 'disaster syndrome' (1956:110-141). The respondents seemed to react as a family unit initially, and then, in a very short period, if the situation allowed (it was more difficult in some of the more isolated farming areas) to act as a larger group, assessing and coping with the disaster as a collectivity. This is probably epitomized by the activities in the Inangahua Camp area.

(2) The Awareness Phase

This phase, which is part of the Inventory Period, is oriented to the realization and awareness that a disaster has occurred by those outside the impact area. If we refer to Wallace's model of Disaster Space (Figure 11) the 'awareness phase' refers to those actions of people living in any of the four areas with the exception of the Total Impact Area and the Fringe Impact Area. The spatial areas of

Wallace's model would have to be redefined for direct application to the Inangahua earthquake disaster. The Disaster Space model infers that the Impact, Fringe Impact, Filter Area and Organised Community Aid Areas are all within the same urban area. This unit of analysis cannot be applied to the Inangahua township and the surrounding farmland. In this example, the Fringe Impact Area extends to Reefton, Westport, Greymouth and the Filter Area extends to Christchurch, Nelson and Wellington. Organised Community and Regional Aid areas can then be referred to as 'National Aid Areas'.

The suitability of Wallace's model to explain the spatial dimensions of a disaster is questionable when applying that model to the 1968 Inangahua earthquake disaster. This research though, will only comment on the discrepancies found between Wallace's explanation of the different disaster areas and those found to be the case in the Inangahua situation. It is hoped to develop a more elaborate analysis of the Disaster Space model elsewhere.

Wallace defines the 'Fringe Impact Area' as that in which minor damage and few or no serious injuries occurred (1956:4). In the Inangahua earthquake this area can refer to Reefton, Greymouth and Westport. Beach (1967) makes the assumption that the people in the Fringe Impact Area are aware of where the Total Impact Area is, and it is only a matter of these people in the Fringe area caring for their own friends and families, then the people in the Fringe Area move into the Total Impact Area to render assistance (1967:18). The assumption made by Beach is that the Total Impact Area is recognizable by those in the region immediately surrounding the Total Impact Area. Wallace makes this assumption also: that it is known where the impact area is, at least in the Fringe Impact, the Filter Area and the Organized Community Aid Area.

In the disaster studied here, there was no knowledge of where the impact area was. People in Reefton thought it was in Reefton, Greymouth residents thought they had borne the brunt of the earthquake, and Westport people had similar thoughts. Even in Inangahua, people thought that the epicentre was elsewhere. Further afield the only knowledge available was that there had indeed been an earthquake. The 6.30a.m. regular news bulletin on the New Zealand Broadcasting Corporation service reported that mild tremors had been felt in New Zealand in places as far away as Timaru (280 Km south east of Inangahua) and Muriwai (700 Km north-east of Inangahua). There was no indication at all that Inangahua was the epicentre; indeed, the earthquake had not been narrowed to any specific location until after 9.00 a.m.that morning.

The New Zealand Electricity Department at Nelson realized that the earthquake must have been centred south of them because power had been disrupted from somewhere in that region. At 6.10 a.m. officials in the N.Z.E.D. in Nelson alerted Helicopters (N.Z.) Ltd. to stand by with one of their craft to fly service personnel and an emergency first aid team into where they thought was the area of power disruption, Inangahua substation. Power had never before been disrupted in that area and they thought that the earthquake must have caused serious damage in this area when they failed to receive any reply from the substation to the radio signals that Nelson N.Z.E.D. was transmitting. By 7.20 a.m. the N.Z.E.D. in Nelson had been in contact with the Nelson Police Search and Rescue Squad who in turn had contacted the Greymouth Police Headquarters. Personnel in the Greymouth Police Headquarters relayed back to the Nelson Police Station that Greymouth was the centre of the earthquake, and that everything was under control. Nelson Police advised the Nelson N.Z.E.D. on the request of the Greymouth Police that the earthquake was not therefore in the Nelson jurisdiction, thus they were directed to withdraw the services of the doctor and nurse who were standing by.

By 8.20 a.m. the authorities at the Nelson N.Z.E.D. were convinced that the centre of the earthquake was not in Greymouth and decided to send its own men via helicopter to the Inangahua substation to check it out. By 8.50 a.m. the Helicopter (N.Z.) Ltd. craft was on its way to Inangahua with the Electricity Department party and a quantity of emergency equipment and supplies in case their suspicions were confirmed.

Meanwhile, the Inangahua County Chairman, living at Inangahua Landing, thought the earthquake had left another area more devastated than his own. He thought the damage would be worse at Reefton. Consequently, after he had fixed the holes in his roof and made sure that all his family was safe, he set off on foot for Reefton to see if he could help or be of any use in his official role. As he went up the road towards Reefton, he began to notice that the visual damage was less severe. "It was not until I got to Reefton at about 8.30 a.m. that I realized the Junction was the worst hit place as far as damage was concerned". From the description of the area he presented to others at Reefton, it was obvious that the northern area had been harder hit than Reefton. It was also around this time that authorities in Reefton realized that they were cut-off from the rest of the outside world by slips, road blockages and from audio communication devices.

In Christchurch, at the Civil Defence Southern Regional Headquarters, the offices were opened, as they always were at 8.00a.m. Between 8.30 a.m. and 9.11 a.m. the Regional Offices had obtained information from Nelson/Marlborough, Hokitika, Greymouth and Westport,and had ascertained the extent of the damage in those places. No communication contact was able to be established with Reefton or Inangahua. It was not until 11.25 a.m. that the New Zealand Railways Office in Christchurch was able to contact the Reefton Stationmaster on their private line that communication was available from outside the Reefton area. From this time on the Southern Regional Headquarters of the Civil Defence and the Civil Defence Commissioner in Christchurch were in contact with Reefton. The Controller of Civil Defence operations in Reefton was able to explain the situation to the Regional Commissioner as it was in Reefton and he could speculate on the plight of Inangahua.

Meanwhile, just after 9.15 a.m. the occupants of the Helicopter (N.Z.) Ltd. craft flew out of the fog that had enveloped the helicopter since taking off from Nelson half an hour earlier, and observed immense damage in the Upper Buller Gorge and New Creek areas. Realizing the magnitude of the earthquake and of the possible injuries sustained by the inhabitants of the township, the pilot headed towards the town with increased urgency. The occupants also noticed that the Buller River was dammed at Newmans Lookout. At 9.50 a.m. the helicopter reached the N.Z.E.D. substation and the Nelson personnel made contact with the M.O.W. Supervisor who had assumed leadership of the Inangahua Camp. The M.O.W. Supervisor told the new arrivals of the situation and also gave them the news of the report of an assumed death due to a landslide in the Lower Buller Gorge area. The helicopter immediately took off to aid in the rescue and climbed to make radio contact with Westport Aeradio giving a full account of the known damage and casualties in the area. The pilot requested that the information be sent to the Nelson Police and the Hokitika Aeradio for advice to Police and Civil Defence personnel. Thus, three and a half hours had elapsed since the earthquake had struck the township and the first outside aid had arrived on the scene.

In Reefton, at about the same time that the helicopter reached Inangahua, the police constable was able to make contact with the Greymouth Chief of Police. The constable was able to give the Chief Police Officer all the information he had obtained from the Inangahua County Chairman about the conditions around Inangahua as well as the situation in Reefton. As a result of this discussion, it was decided that a search party should leave immediately for Inangahua. The Reefton Constable, the Reefton Hospital Superintendent and a Forestry Worker equipped with a two-way radio, set out at 10.45 a.m. for Inangahua by vehicle and by foot.

Back in Nelson, the Electricity Department officials' concern for the Inangahua region resulted in representatives of the Earthquake and War Damage Commission and the New Zealand Geological Survey flying to Nelson at 9.00 a.m. As the centre of the earthquake was still unknown at this stage, with complete certainty, these representatives hired a plane and flew over the Murchison area, down the Buller Gorge to Westport. Reports of the damage were relayed back to the Geological Survey, the Seismological Observatory and the Earthquake and War Damage Commission headquarters. At 9.15 a.m. the Director of Civil Defence in Wellington received the news of the earthquake from the N.Z.E.D. who were still concerned for the Inangahua area.

At 10.25 a.m. a Police party left Greymouth for Reefton to assist in rescue activities. By this time it was apparent that Inangahua Junction was near the epicentre and had received the most damage and injuries.

5.3.5 Rescue

The beginning of purposeful extraction, self-help and mutual aid among the victims initiates the rescue stage (Powell 1954:II 8). Rescue then is characterised by amateur, unorganised activity carried out by the disaster victims themselves. Dynes adds that this period also involves the extraction or survivors, protective activity and pre-cautionary activity against secondary threats such as electrocution by fallen wires, fire and escaping gas (1970:57).

Chapman states that

> "...the phase of rescue is divided from that of immediately preceding impact by naturally indistinct boundaries".
>
> (1962:17)

This is certainly the case in the Inangahua disaster because some of the activity that is expected at this stage, and which differentiates the rescue period from the inventory period was not present, there were no secondary threats to endanger lives; fires, escaping gas, fallen live wires were absent; and there was no mass rescue activity to free trapped victims, nor were there many injured people to care for. The absence of these characteristics can be explained in part by two factors:

(1) Circumstances (e.g. all electricity in the area was disrupted by the earthquake, thus no fallen live wires were strewn over the ground, although telegraph and power poles were toppled). Inangahua township, like many small South Island settlements did not have a gas reticulation system. The time of impact and the absence of any industrial plant diminished the chances of fires because almost the whole population, with the exception of some farmers, were asleep, and no fires had been started for cooking/heating purposes.

(2) The size of the township, the population density, and structure and type of material used in most of the dwellings (wood[1]) may help to explain why there was a minimum of injuries and no consequent mass rescue activity; the news, rescue bid and ultimate discovery of the landslide victim was the sole example of organised rescue activity, but as will be shown later, this incident did not mark the division from one disaster period to another in all of the three sub-communities.

In some sense this period can be defined not so much as being the beginning of the rescue period as the end of the inventory period. This is because there was an absence of entrapped victims and no secondary impact to counteract that compelled the population to achieve any collective positive activity that is characteristic of the rescue period suggested by Powell and Rayner (1952) and Powell (1954). The rescue phase was not so much a collective orientation immediately recognizable from other actions, but more an activity of a few 'spontaneous leaders' who initiated activity that gradually involved more people into performing actions that could be considered characteristic of the rescue period. There was no complete division of activity by all victims at one time that marked the arrival of the rescue period. If we take the activity of the Inangahua Junction area as an example:

[1] Most of the buildings were of a single-storeyed type with a wooden frame and timber exteriors. Wood is less rigid than masonry, and is therefore more appropriate for buildings in earthquake-prone areas because of its ability to absorb more of the earthquake shock than brick/masonry type buildings.

The observation has been made in the previous section that the inventory period lasted until mid-afternoon, from the moment of impact until the men who had gone to aid in the search for the landslide victim had come back to the Junction. During the absence of these men, the rest of the Junction residents remained in an unorganized state.

Prior to the earthquake, the Junction, unlike the Inangahua Camp[1], had no recognizable authority structure. None of the residents in the Junction had occupational roles which enabled them to assume the position of a leader in the post-emergency period as an extension of their occupational role. Because of this, there were no expectations on any resident to fulfil the role of leader to the sub-community. None of the residents had had prior leadership experience, nor had they had any experience in decision-making activities, other than those performed in the family setting.

The leadership which emerged in the Junction, which was manifested after the men had returned from helping in the search for the landslide victim, was assumed by a corps of residents (how many it is not known) coming to collective decisions and organising the activities which they considered

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[1]The Camp had two well defined authority structures based on the official hierarchy within the Ministry of Works, and the Electricity Department personnel. After the earthquake, the Officers-in-Charge of these two Government departments took over the leadership of the Camp, the M.O.W. Supervisor assuming overall leadership of the entire Camp settlement. The post-emergency leadership roles required little or no modification from the pre-emergency roles. Both Officers-in-Charge assumed responsibility for the safety and welfare of their employees and their families, and also of the safety and welfare of other residents in the Camp site. Had the two Officers-in-Charge been injured or killed, the authority structure would have had to be reformed, presumably changing quite markedly the activities that were consequently performed.

were necessary for what they thought would be a prolonged stay in the area under disruptive conditions. Some people began to dig toilets, acquire bedding, clothing and food, others were in an unorganised state, undertaking little or no mitigatory activities. The community action as a whole, though, began to be transformed from one of non-activity and no organisation, into one of appropriate activity (getting clothes, bedding, food, locating suitable shelter) and organised behaviour and division of duties (some of the residents dug toilets, others located shelter). A decision was made to move everyone in the Junction up the road to the Railway Station houses which were thought to have suffered less structural damage and were not endangered by landslides and advancing slips. All the residents were then advised of this decision and preparations were undertaken to expedite actions.

It seems that the activities undertaken by some of the men from the Junction in searching for the missing woman in the landslide brought some realisation of the situation in which the sub-community was now facing to these men. Up until that time the Junction residents were still in a situation of assessing their position (stocktaking, i.e. inventory period), and coming to a realisation of what had happened. Little or no attempt was made to mitigate the situation. After returning to the Junction, the searchers began to assess their own situation. With the help of some of the people who had not participated in the search for the missing body, members of the search group began to organise the community into concerted actions that could be objectively considered part of the rescue period.

Powell makes the point that a doctor in the impact zone giving emergency first aid does not initiate the remedial stage (1954:II 11). The arrival of the Superintendent of the Reefton Hospital, along with the Reefton police constable and the Forestry serviceman was still in the rescue period of the disaster in the Junction.[1] The rescue phase ends "as a distinct stage when officials, agencies and trained personnel begin to move in and take charge" (Powell 1954:II 10; Chapman 1962:19; Dynes 1970:57). This phase occurred in the Junction sometime in the late afternoon/evening when a Civil Defence officer ordered the residents to make their way to Reefton via the landslide that blocked the Junction-Reefton highway at Oweka[2], where buses would be provided to take them from the Landing Bridge to the Civil Defence Headquarters at the Forestry Services huts in Reefton. With the arrival of the Civil Defence officer, the decision-making process passed from internal resolutions based on the residents to one of external decision-making based on the incoming rescue agencies.

At Inangahua Camp the rescue period was initiated much earlier and activities could be more positively related to Powell and Rayner's rescue period. This was no doubt due to the more clearly defined authority structure and the

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[1]Similarly, the arrival of the helicopter at the Camp site at 9.50 a.m. and the taking of the two injured people from the Lower Buller Gorge to Reefton Hospital does not constitute the beginning of the remedy period for those particular sub-communities.

[2]It was feared that a dam which had been created by a slip upstream on the Buller River would break and flood the low-lying river flats. Evacuees were advised to stick to the hills and avoid river flats in case the dam burst.

pre-emergency organisational structure within the Camp. It has already been stated that within five minutes of the main earthquake, the M.O.W. Supervisor and two of his work-mates had made a preliminary reconnaissance of the Camp to establish the situation as best they could, given the circumstances. By daylight, that is, within the first two hours, the M.O.W. personnel had gathered a large section of the Camp residents together in the M.O.W. Yard, had arranged groups to build fires and commence breakfasts. Other M.O.W. personnel, with some of the residents, had searched the township once more; a search party went as far as the school and checked on all the houses on the way. Within this two hour period other residents had gone up the road towards Murchison, having got as far as Dee Hill where the road was blocked by slips. Vehicle access was denied them, so all search parties had to travel by foot.

A similar situation existed in the Hydro Camp, and within two hours of the impact, all members of the Inangahua Camp had gathered either at the Hydro or the M.O.W. yards. Those who wanted food were fed, the township had been searched by parties to ascertain the extent of the damage[1] and search parties had been sent to various parts of the area to make contact with people and assist if necessary. By mid-morning some Hydro staff had contacted the farming community at New Creek, Inangahua Junction had been contacted and from 6.00 a.m. onwards M.O.W. personnel had tried to make radio contact with

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[1]The M.O.W. Officer-in-Charge stated that he estimated 70 per cent of the houses were uninhabitable in the township.

the outside world. At 8.30 a.m. two M.O.W. employees took a radio trans-receiver up to Dee Hill and around 9.00 a.m. they managed to make contact with Gisborne (700 Km north east). Gisborne was told of the situation and was asked to relay the message to the Westport Ministry of Works Depot.

Also at around 8.30 a.m. that Friday morning, contact by a Lower Buller Gorge resident was established with the Junction. A farmer had walked out with the news that a landslide had occurred which had swept away his house and that two people were injured, one of whom was missing. Messengers were sent from the Junction for assistance in the search for the missing person, and M.O.W. staff organised their members to form search parties. The Hydro personnel divided themselves into two groups, half of them went on the search and rescue party, the other half stayed behind and attempted to restore the electricity flow, and later searched the surrounding area of New Creek.

The Rescue Period took on a new turn with the arrival of the helicopter from Nelson, sent by the N.Z.E.D. The helicopter landed at the electricity substation with the N.Z.E.D. personnel it had picked up at Nelson, and on the request of the Officer-in-Charge, proceeded to the site of the landslide to assist in the search for the missing person. The pilot also radioed a description of the situation at Inangahua to Westport and requested that this information be passed on. The helicopter landed at the landslide site at 10.30 a.m. and with the assistance of a state registered nurse from the Camp (the wife of the school teacher), the farmer and the injured person were taken on board and flown to Reefton Hospital for emergency care.

Back at the Camp, the Hydro personnel were still trying to re-activate the power supply, and with the assistance of the arrivals from the Nelson N.Z.E.D., they managed to get the power restored.[1]

The inhabitants of the Camp were milling around the work yards, sight-seeing and trying to assess the damage to their properties. Some of the residents were now becoming aware that the situation they were facing was graver than they first thought, especially with the news of the landslide tragedy: "We didn't realize how bad it was until we heard that someone was missing".

After flying the two injured people to Reefton Hospital, the Helicopter (N.Z.) Ltd. craft left Reefton with a state registered nurse and three policemen aboard to return to Inangahua. Radio sets were taken to establish a link with the

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[1]This activity, strictly speaking, is more in keeping with the 'recovery period', that is, it is oriented towards resuming normal activities (Powell 1954: II 12). The actions of the Hydro personnel - why they returned to work-related activities so soon after the disaster could be explained by: (1) their families were all safe and this fact was known to the men, hence alleviating any fear or concern on the part of the employees about their families. This situation was augmented by the fact that workmen and their families were in close proximity to the work-place, hence there would be an absence of any concern about leaving the family in such a time of duress; (2) a division of labour had been established in the Camp area that left the Hydro employees free to concentrate on the task of restoring power without feeling they were neglecting their fellow residents; (3) the occupation of a N.Z.E.D. employee is considered to be an 'essential occupation', hence in time of emergency the role these men play is vital: electricity must be connected as soon as possible to areas outside the disaster area, as well as in the impact area for certain activities to be undertaken. Because of these three factors, the problems of 'role conflict' (refer Biddle and Thomas 1966) would not arise, hence the Hydro personnel would be free to return to their work-related activites.

outside world, particularly with the Civil Defence Headquarters at the Forestry Camp in Reefton and the Reefton Police Station. Just after 11.00 a.m. the helicopter landed at the Hydro Camp. Meanwhile, at 11.00 a.m. in Reefton, the Controller of Civil Defence declared a state of emergency for the whole Reefton region, including Inangahua.

In the farming community the termination of the rescue period was achieved when evacuation began. This activity, which forms the cut-off point from one (disaster) time period to another also acts as a partition between the residents because evacuation was undertaken in some cases before others, the people in the Lower Buller Gorge and some families in New Creek and Brown Creek Road were evacuated that day. Others in the New Creek and Brown Creek Road were flown out the following day (Saturday 25 May), whilst still others in Inangahua Landing were not evacuated at all.[1] Actions common to all the outlying respondents in this rescue period will be described, then the activities of the two sets will be considered according to time of evacuation.

Generally, the farming population recovered from the impact within the first two hours before daylight, and where possible[2] contact had been made with their neighbours within that two hour period. Those that could, had signalled to each

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[1]The families that were not evacuated were contacted by helicopter on Friday but were not in any need of immediate assistance, nor were they in a predicament that justified their removal. Electricity was restored that night to the area and the farm residents were able to live adequately until the restoration of damage was achieved at a later date.

[2]Some of the farms were isolated because of distance that was exacerbated by slips and unsafe bridges.

other via their car-lights or had walked over to their neighbour's farm. With the arrival of daylight, assessment of the damage sustained was carried out and farm chores were fulfilled, cows milked, pigs and dairy herds fed.

The farmers in the Lower Buller Gorge assisted in the search for the landslide victim. An hour after the body had been found, the decision by the M.O.W. Officer-in-Charge and the Hospital Superintendent at the Camp was made to evacuate everyone from the area. Two sons of a local farmer started walking to Inangahua to inform the people in the township that the body had been found, and were met en route by someone from the town coming out to inform the farming community in the Gorge to prepare for evacuation. Activity in the Gorge was then oriented towards this end which began in the late evening.

In the Inangahua Landing-Brown Creek Road area, people were beginning to clear up the damage and construct make-shift facilities for cooking and heating. Contact was made with neighbours to offer assistance and seek their welfare. Generally, they organised themselves to cope with the changed environment. People attempted to clean up the mess inside their homes caused by fallen crockery and provisions, food was prepared for meals[1] and bedding was established for the night.

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[1] In New Creek, the remaining 13 members of two families that were not flown out that night had elected to stay in one of the homes. A sheep was killed to provide meat.

During the middle of the day, the helicopter called on the farms in the Buller Gorge and New Creek area to check on the residents and ascertain their condition. The occupants of the craft advised the New Creek people that if they were happy with the idea, they would probably be better to stay where they were, rather than be ferried to the township where conditions were no better. From the account given by the pilot, the New Creek farming residents considered it was much wiser to stay where they were. One of the farmhouses to which the families finally settled in had running water, sewage system intact and a diesel-generated electricity supply, facilities unavailable in the town.

At about 2.00 p.m. the helicopter returned to the outlying districts and delivered quantities of bread, obtained from a bakery truck at Rotokohu. The remaining bread was taken to the Camp.

At 2.00 p.m. in the afternoon the Reefton Civil Defence Controller advised the Civil Defence Southern Regional Commissioner of the decision to evacuate the people from Inangahua township because of the fear that the dammed river might break. The Commissioner arranged an Air Force plane to fly Ministry of Works engineers to inspect the blockage. Meanwhile, the private craft of Helicopters (N.Z.) ltd., since about 1.00 p.m. had been evacuating workmen and marooned truckers from their sites to Inangahua Camp. The pilot requested the assistance of more helicopters to aid in the procedure. At about 3.30 p.m. the M.O.W. Officer-in-Charge, the Reefton Hospital Superintendent and the Police

Officers now at the Camp agreed that an evacuation of the entire area would have to take place because, apart from the danger of the dam bursting upstream, the township's amenities could not provide the essential services to maintain a community. The M.O.W. Officer-in-Charge sent out a radio message to the effect that they were going to initiate an evacuation of the women, children and elderly because of the conditions that now prevailed in the area. He also asked for more helicopters to assist. Almost immediately, the Camp leaders got a radio message back informing them that the National Civil Defence Headquarters in Wellington had arrived at a decision, based on the information that had been relayed to them, that total evacuation should begin immediately.

This decision for some of the outlying farming areas, marks the end of the rescue period and the beginning of the remedy period (Powell and Rayner 1952; Powell 1954). Evacuation of the New Creek and Lower Buller Gorge regions began about 6.30 that evening. As will be shown in the next section, the remedy period had begun much sooner in the Camp, and the Junction sub-communities. For the two farming families not evacuated that Friday night from New Creek, the night passed with little sleep because of the constant and vigorous aftershocks. The following morning the two families were just about to have breakfast when a helicopter landed, the pilot informing them that they had to leave the area. The ladies considered going out with their children, the men stating their preference to stay. The pilot relayed these intentions back to his base, but was instructed that everyone had to be evacuated. By 11.30 a.m. on Saturday 25 May, all the people residing in the disaster area had been accounted for and the evacuation task was complete.

5.3.6 Remedy

With the arrival of the Police party aboard the helicopter on its return to Inangahua from Reefton (to take the injured people to hospital), the remedy period began at Inangahua Camp at 11.08 a.m. Friday morning. By 11.25 a.m. the helicopter had taken one of the Police party to the scene of the search for the missing landslide victim to supervise activities there. Another member of the Police party began to set up a communication link with the Reefton Police Station via a radio transreceiver that had been brought in on the helicopter. By 2.08 p.m. that afternoon, contact was finally made with Reefton, although the reception was very poor. The third member of the Police party, the sergeant in charge of the Inangahua operations at the Camp, stayed at the Ministry of Works Camp with the M.O.W. Officer-in-Charge and other M.O.W. employees to augment the organisation of activities. Although the blockage and consequent damming of the Buller River was known, there was no decision made at this early stage to evacuate the township.[1] Indeed, the leaders in the Camp did not know whether they would be able to evacuate everybody, given the knowledge they had of the physical damage throughout the region, especially the routes out of Inangahua to Reefton. One of the local residents was given the task of billeting the Camp people in the houses that were structurally sound in the Camp, in the event that

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[1] After making the trip to New Creek at 11.10 a.m. the helicopter pilot advised the M.O.W. Officer-in-Charge and the police sergeant that it would be necessary to evacuate the low-lying farms of Rahui-Berlins if the dam had not breached by dusk.

they all had to stay the night. Some of the women took over the catering role to provide everybody with a light lunch "feeling that it would be better if we had our main meal at night and at least we could go to a somewhat uneasy sleep with a relatively full stomach".

Early in the afternoon of Friday 24 May, the helicopter began to evacuate isolated pockets of people that had been stranded or cut-off by the earthquake. At 12.40 p.m. the helicopter started airlifting twelve men and their gear (on three flights) from Baigants Sawmillers Ltd. in New Creek to Murchison. At 1.40 p.m. the helicopter found drivers marooned in the Upper Buller Gorge and transported them out of the area. At around 3.00 p.m. the craft picked up drivers from the Lyell region and took them to Westport. The pilot had earlier that day located a derailed train between the Landing and Cronadun, but there was no sign of the crew. Just after 2.00 p.m. while searching for the doctor and the police constable who were walking in from Reefton to the Junction, the pilot located a baker's truck at Rotokohu. The pilot loaded all available space in the craft with bread and then proceeded to distribute the loaves as far as Berlins Hotel and to settlers at New Creek and Browns Road.

The Reefton hospital superintendent, the Reefton police constable and the Forestry serviceman reached the Junction about one o'clock that afternoon. After assessing the situation there, and making sure that there were no serious injuries, the party went on to the Camp. They arrived at the Camp at about 2.30 p.m. and the doctor immediately set about inspecting the Inangahua Camp to assess the situation. The doctor reported to the police and the M.O.W. Officer-in-Charge that the sewage and water reticulation system were now a health risk. With this knowledge, and the physical destruction that had already taken place in the Camp and Junction, along with the constancy of aftershocks and the knowledge of the dammed river, a decision was made by the doctor, the police and the M.O.W. Officer-in-Charge at 3.30 p.m. to evacuate the township. This decision was relayed to the Reefton Police Station by the M.O.W. Officer-in-Charge. A few minutes later, a radio message was sent from Reefton to Inangahua advising the Inangahua party that the National Civil Defence Headquarters in Wellington had just issued a general order to evacuate the whole area. The doctor then addressed the Camp residents telling them of the order to evacuate and the reasons why. He told them that they had time to pack an overnight bag of essential clothing gear if they wanted, and that men and children over the age of twelve should prepare themselves to walk out. The others were told that preparations were being made to fly them out by helicopter.

At the same time that the message from the National Civil Defence Headquarters was relayed to Inangahua, the helicopter which had flown some stranded drivers to Westport, returned to the Camp. With the arrival of the helicopter activities were made to begin evacuation of the town. While preparations were being undertaken, another helicopter arrived from the Murchison area. By 4.00 p.m. both helicopters had commenced evacuation, the newly arrived Hiller craft taking up to four adult equivalents per trip, and the Helicopter (N.Z.) Ltd. Bell Jet Ranger up to nine per trip. At 4.30 p.m. that evening a second Bell helicopter from Helicopter (N.Z.) Ltd. arrived from Nelson and joined in the evacuation procedures. A third Helicopter (N.Z.) Ltd. craft arrived at 5.15 p.m. In order to minimise the time of the helicopter flights and to maximise the evacuation, the helicopters were taking the evacuees to Rotokohu (15 Km south of Inangahua and 11 Km north of Reefton), and from there the residents were transported by buses to Reefton. A Reception Centre had been established at the Reefton Forestry Services Camp to handle the arrivals.

By the time darkness began (at about 5.30 p.m.) 103 people had been flown out of the Camp settlement to Rotokohu. At around this time (5.30 p.m.) the first of the two Army Iroquois helicopters arrived from Manapouri (where it had been involved in activities related to a visit by the Duke of Edinburgh), and began evacuation on a limited scale because of a shortage of fuel. At 6.00 p.m. the second Army Iroquois arrived with fuel for both of the Army craft. By now there were six helicopters assisting in the evacuation of the Camp residents. By 6.30 p.m. the evacuation of the Camp was complete. A decision was then made by the flight crews of the civil aviators and the Army military operators in the helicopters to divide the outlying regions up and begin evacuation of the surrounding settlements. Civil aviators concentrated on Rahui and Berlins farms, while the military concentrated on the New Creek area.

In Reefton, the Forestry Services Camp had been designated as the Civil Defence Headquarters and the Reefton Centre for Reception of the evacuees from the impact area. Civil Defence authorities in Reefton had organised personnel to cater for the registration of evacuees, arrangements of billets had been undertaken, meals, clothes and the overall welfare of the incoming evacuees was arranged by the Reefton Civil Defence organisation. At 6.00 p.m. the first evacuees arrived. All people were registered on arrival as they entered the building. As they entered the main buildings they were given cups of tea and other liquid refreshments for the children. A television set had been installed for the children[1], and adults could collect mail and telegrams. Facilities were available to send telegrams to relatives. From the entrance of the building, the evacuees went into a large reception room where meals were served. While evacuees were in the building, registered names were delivered to other Civil Defence volunteers, who arranged billets, and as each family left the Centre, transport was supplied to take the evacuees to their billeted homes. At 6.00 p.m. there was an urgent message from a Ministry of Transport Officer at the Rotokohu helicopter landing site that blankets were needed for evacuees awaiting transport to Reefton. Supplies of blankets were sent from the Civil Defence Headquarters in Reefton to Rotokohu.

[1]Television had only just begun transmission over the West Coast and it was a novelty to the children, which kept their minds off the experiences they had encountered during the day extremely well.

At Inangahua Junction, the situation was a little different. Evacuation was undertaken late in the afternoon following the order by a Civil Defence official from Reefton that the area had to be cleared. The Junction residents were advised to keep to the hills and not to follow the river flats when they evacuated their houses. There was concern that the dammed river in the Upper Buller Gorge might breach and cause flooding. Progress was slow and difficult, especially for some of the older residents, all of them having to traverse the landslides and slips that had covered the roads. There seemed to be some confusion over the evacuation of the residents from the Junction. These residents were told by the Civil Defence official that transportation would be waiting for them at the Reefton side of the Oweka slip which would take them to Reefton. After the party of residents had negotiated the slip in the dark for two hours "there was nobody to meet us once we had made the crossing over the hill". It seems as if the Junction people were forgotten by the rescue authorities who had fully concentrated their resources on evacuating the Camp area. According to one respondent, "we were just standing around waiting in the dark, just wandering around". A Power Board truck with an employee in it happened to come along the road a little after the party had crossed the slip, and was surprised to find the group of people milling around. The truck-driver took some of the party in his truck down the road to where the buses and other vehicles were waiting for the Camp evacuees to be discharged from the helicopters, and arrangements were made to ferry the Junction residents to the Civil Defence Headquarters in Reefton. This episode again illustrates the lack of authority structure and decision-making processes that were apparent among the Junction residents. If there had been a recognised or a designated leader among the Junction residents, the unorganised milling around and lack of initiative of the respondents to plan appropriate activities after they had negotiated the Oweka slip and found no-one there to assist them, may have been channelled into appropriate action (for instance, instead of "standing round in the dark" for the transportation which was assumed to be waiting for them, the residents could have organised a party to continue walking down the road towards Rotokohu and make contact with the rescue authorities that were known to be there).

By 8.30 p.m. 173 people had been registered at the Civil Defence Reception Centre. By 9.15 p.m. the number had increased to 189. There were still 32 people known to be in the region that night who were not flown out. Nine people remained at the Camp site.[1] The Headquarters of the Inangahua Camp was moved to the Inangahua Primary School which was situated on high ground, and the playground was used as a helicopter landing pad. Thirteen of the known 32 people still remaining in the area were in the New Creek area. They were flown out via helicopter early on Saturday morning to the Reception Centre (refer Table VI).

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[1] The nine people were the Police Sergeant, three constables, the Officer-in-Charge of the M.O.W. Camp, two N.Z.E.D. employees and two schoolteachers.

Method	24 May (a)	24 May (b)	25 May (a)	25 May (b)	Totals
Helicopters	119	-	50	-	169
" dead	-	-	-	1	1
" hospitals		2	-	-	2
" to Murchison		12	-	-	12
" to Westport		3	-	-	3
Landrover	8	-		-	8
Walked	62	-	7	-	69
Drove out:					
from Landing	16	-	-	-	16
" Cronadun	21	-	-	-	21
Totals	226	17	57	1	301
		Total Evacuated			301

(a) To Reefton Civil Defence Reception Centre
(b) To elsewhere

Source: Ministry of Civil Defence, Department of Internal Affairs: Report on the Inangahua Earthquake NZ May 1968, p.29

By the end of the first day the following agencies were working either directly in the impact area, or were organizing and establishing facilities and amenities for the evacuees of the impact area:

1) The Police from Reefton and Greymouth.
2) Civil Defence. The Reefton Civil Defence was the co-ordinating agency for all disaster-related activity in the region and the key organizer for evacuees.
3) The Army provided helicopters for evacuation.
4) The Royal New Zealand Air Force provided a communication landrover and a tanker. Wing-Commander Dallison assisted in the organisation at the Civil Defence Headquarters at Reefton.
5) The New Zealand Electricity Department provided the initial movement into the disaster area, flew in support teams and rescue equipment.
6) The Ministry of Works flew in engineers and assessors to gain an understanding of the situation.
7) The Earthquake and War Damage Commission flew in assessors to Greymouth and Westport and also flew over the impact area to assess the extent of the damage.
8) The Forestry Service provided personnel, equipment and accommodation to evacuees.
9) The Reefton Hospital Superintendent walked to the impact area to render assistance. The hospital provided amenities for the injured and distressed.

10) The Ministry of Transport aided in communication services, reconnaissance of roading throughout the area, and transported officials, equipment and emergency personnel.
11) Helicopter (N.Z.) Ltd. provided three helicopters and pilots in the subsequent evacuation of evacuees. This company also flew in the initial contact party from Nelson, flew to all known areas of settlement in the area to assess damage and assure residents that their predicament was known. Helicopter (N.Z.) Ltd. craft flew in food to outlying areas and aided in communication.
12) The Salvation Army Greymouth Centre sent $NZ 1,000 in cash for immediate relief to Reefton-Inangahua residents. Captain Brown of the Greymouth Salvation Army offered his assistance.
13) The Geological Survey and
14) the Department of Scientific and Industrial Research sent in personnel and equipment to observe the results of the earthquake and record aftershocks and their effect.

By the time the remedy period had ended (May 27, Monday) the activities of the agencies had been increased and further agencies were drawn into the relief organisation:

1) The Police contingent had been augmented by personnel and equipment from the Christchurch police district.
2) The Army had transported a landrover and a scoutcar, communication equipment and other equipment (e.g. a mobile kitchen) to aid in the resettlement of evacuees.

3) The Royal New Zealand Air Force provided more radios to augment the communication channel between Inangahua and Reefton.

4) The Salvation Army brought in two truckloads of clothing which had been donated by Greymouth residents following an appeal broadcast by the local radio station.

5) The Greymouth station of the New Zealand Broadcasting Corporation offered its services and personnel to transmit messages and announcements.

6) The Resident Engineer of the Ministry of Works arrived from Westport to Inangahua to assess the situation.

7) A Department of Health official travelled to Inangahua to assess the health risk caused by the earthquake.

The day following the earthquake (Saturday 25 May), the evacuation of all Inangahua residents was completed. All evacuees were sent to the Forestry Services huts at Reefton and from there they were distributed to homes, initially in the Reefton area. A total of 283 evacuees were received at the Headquarters Reception Centre. In Inangahua, a communication and reception centre was set up in the Inangahua Primary School Dental Clinic to process all the in- and out-going messages. The police at the impact area set up two-man parties to patrol and guard the now deserted and abandoned homes and premises in the township. In the latter portion of Saturday morning the police numbers at Inangahua increased to enable the arrangement and supervision of the inventory, removal and storage of furniture and personal effects from the vacated homes, a precaution against theft and looting at the request of the Earthquake and War Damage Commission's representative in the region.

At the Civil Defence Headquarters in Reefton, procedures were arranged to optimize the use of available personnel and decisions were undertaken to co-ordinate the various agencies involved in the mitigation of the earthquakes effects. An Information Officer was appointed to attend to media enquiries. The establishment of a Signals Officer and a Signals Centre to co-ordinate the Army, Air Force, Police and Forestry radios, as well as the local telephone system was undertaken to restore some order in the communications section of Civil Defence. The Welfare Section of Civil Defence was re-organised into two. One section was to oversee the general aspect of welfare, the other section focussed activity on catering, clothing, packing and distribution of foodstuffs to the evacuees. Roadblocks were established at Rotokohu, Inangahua Landing and at Reefton on Highway 69 to Inangahua. Passes had to be obtained from the Reefton Civil Defence Headquarters for all people who wished to gain access to Inangahua.[1]

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[1]Passes were issued daily to farmers in order that they may feed their stock. Owners of business premises and operators of essential services (for example, the petrol-tanker driver) were ferried into the region from Sunday May 26 onwards to try to establish some semblance of order in the area.

5.4 The Post Emergency Period

5.4.1 Recovery

Powell and Rayner's model of disaster time states that the next discernible stage after 'remedy' is that of the 'recovery period': that is, the functions and the predominating activities which come after the period which is highlighted by the arrival of trained, professional or organisational persons from outside the impact area who supervise search and rescue, take charge of preventive and security measures, organise and supervise the evacuation of victims and the first aid or other medical treatment of victims. The period after this is Recovery. The remedy period thus marks the end of the emergency period and leads into the beginning of the post-emergency period (Powell 1954: II 11).

Recovery in Powell's words, is

> "...the resumption of normal functions, of responsibility for self-help, and the slow trek back to the status quo ante (sic) or a reasonable facsimilie of it".
>
> (1954: II 12).

There is a problem of 'fitting in' the recovery period, as Powell has defined it, in the Inangahua earthquake disaster so that it follows the chronology of events after the remedy period. Taking the three criteria that Powell uses to define the recovery period, it will be attempted to illustrate that two of the three criteria are inappropriate explanations of the activity that immediately followed the remedy period in the Inangahua earthquake. If the three criteria are taken as part of a whole definition of the situation by which the recovery period can be explained, then the problem of contradiction arises, as will be shown. If, on the other hand, the three criteria are taken separately the problem becomes one of choosing the criterion most applicable to the situation at hand and rejecting the others. This problem of defining the recovery period based on Powell's statement arises because the three criteria developed by Powell do not furnish an adequate explanation of what happened in the Inangahua situation immediately following the remedy period.

1) "The Resumption of Normal Functions"

"Function" in this case, refers to Caplow's definition whereby it is taken to mean the part played by any element of a social system in maintaining that system (1971:670). Therefore, the "resumption of normal functions" implies that the established social structures, procedures, processes and interactional pursuits that are common to a given society or community are once more present. "Resumption" in this case implies a 'carrying on', it implies that a halt in the proceedings has occurred, but now 'normal functions' are once more established. Given this, the implication for Inangahua township is that the social and physical structures are present in their former pre-impact state.[1] In the

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[1] In its pure form, the resumption of normal functions also suggests that nothing has altered - what and who were present before are present now. 'Normal' functions between individuals cannot be maintained if one has since died due to the earthquake, or hospitalised (unless that was the situation before the earthquake). Similarly, business transactions cannot be 'resumed' if the premises that the transactions were conducted in are no longer there, rendered inoperable by the earthquake.

chronological sequence of events in Inangahua after the end of the remedy period, the situation described above leaves a time gap of between Saturday May 25 to some time in August when the bulk of the families had re-entered the township permanently, the majority of the houses had been restored to habitable condition, the roading and water/sewage reticulation was functioning, and business transactions were being performed.

2) "Responsibility for Self-Help"

The problem of using this criterion as a basis for the beginning of the recovery period is that there was a considerable gap between when the residents were evacuated out of the impact area to the time they were allowed back into the region again on any permanent basis so that they could in fact achieve responsibility for self-help, that is, before they could restore their houses and livelihoods to pre-impact standards. Some of the men were allowed back the day after the impact, but not to restore their own homes[1]. These men were airlifted into the township to begin restoration of power facilities, clearing up slips, covering holes in house roofs with tarpaulins. Farmers were airlifted in to feed their stock. All of these residents had to be airlifted out of the region every day by 5.00 p.m. It was not until 3 June 1968 that women were allowed into the area, but only if escorted by their husbands, and only if they were both out of the area by 5.00 p.m. that same day. After June 16, 1968

[1] One respondent stated that "it was about a fortnight later that I was able to get back and clean up my own property. Previously I was engaged in restoring N.Z.E.D. equipment".

farmers were, if they desired, permitted to live on their farms instead of being airlifted out each night, but this permission did not extend to the farmers' wives or children. It was not until all restrictions were lifted on June 19, 1968[1] that people were allowed back into the region on any permanent basis, but even at this date the water and sewerage systems were not operating properly, and the majority of the houses had not been fully restored. The ability to perform self-help activities by the residents of Inangahua was severely restricted until they were allowed into the region permanently, and they were not permitted to do this until the area had been made habitable and reconstruction/restoration had taken place.

3) "The Slow Trek Back to the Status Quo Ante" (sic)

This criterion infers that a period of time will elapse before the impact area is restored to the pre-disaster situation "or a reasonable facsimilie of it". The implication in this criterion is that there may be a long period of extensive welfare and reconstruction activity before the system is restored to the original state. It differs from the two former criteria in that this statement recognizes that the recovery period is one of a (slow) return to normal, there is no implication, as in the first criterion that the return is an almost spontaneous, automatic resumption of activities/functions immediately after the remedy period.

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[1]The Civil Defence lifted the state of emergency off the entire region on 30 May 1968, but declared the Inangahua township area an 'Emergency Police Area', therefore still placing restrictions within the area until 19 June, 1968.

This particular criterion recognises that in order to achieve 'the resumption of normal functions', there are antecedent operations and activities that have to be undertaken. It differs from the second criterion in that it does not apportion this activity on any one section of the population. There is no implication that the impact population itself performs these activities or operations, nor does it suggest that the recovery operations are the actions or responsibility of 'outside' or external agents/agencies. The third criterion merely states that efforts have to be made to return the impact area back to a state similar to that before impact. This criterion allows for greater flexibility, both in the realistic assessment of the restoration process, and for its use for cross-cultural analysis because it allows for different political, economic, and thus different 'welfare systems' that operate in different countries throughout the world where disasters occur, and where this model, or derivations from it can be applied.

Recovery in this sense suggests a re-creation of the conditions that were. Recovery aims at restoring the population insofar as possible to the pre-impact physical and emotional status, and at repairing the damaged material culture to its pre-impact status, again, as far as possible. With the recovery period defined in this manner, the 'recovery' of Inangahua can be seen to begin on Monday 27 May 1968, three days after the earthquake struck the township. It is this last criterion that will be used as a definition of recovery and, as such, allows the events that occurred in the Inangahua area to follow with more precision the 'disaster time' periods suggested by Powell and Rayner (1952) and expanded by Powell (1954).

From Saturday 25 May to Monday 27 May 1968, activities in the impact area consisted of three main operations:

1) Some of the residents who were under the employment of Government Departments with establishments in the impact area were allowed back to attempt restoration of essential services, particularly the N.Z.E.D., the Post Office, and the Ministry of Works personnel;
2) Farmers were allowed back to their farms to feed stock; and
3) Police were asked by the Earthquake and War Damage Commission representative to arrange and supervise the inventory, removal and storage of furniture and personal effects in order to facilitate in the repairing of houses.

The Government employees (with the exception of the Police) and farmers were obliged to withdraw from the area each night at 5.00 p.m. The Police maintained a 24-hour surveillance in the area, being replaced by colleagues at specified intervals authorised by the medical authorities and the police hierarchy. Members of the police contingent staying in the Inangahua Camp were becoming mentally strained as a result of being exposed to the constant earthquake aftershocks. The aftershocks prevented the policemen from sleeping without interruption. During the day, inspection of unsound properties, and the inventory, and removal of furniture and personal effects of the residents in the houses became hazardous with the constancy of aftershocks, some of which registered over 5 on the Richter magnitude scale. Ministry of Works personnel operating in the area during the daylight hours, as well as the police contingent in the Inangahua township reported digestive upsets; this complaint may also be attributed to the mental uneasiness experienced by these men as a result of the aftershocks.

The activities prior to Monday 27 May 1968 are more suggestive of the emergence of the recovery period. This period, described above, can be considered as a 'phasing in' of the recovery period that was fully recognizable as a recovery period, as defined by Powell and Rayner (1952), on Monday 27 May 1968, when the Ministry of Works sent in a team of 10-15 carpenters, two plumbers, one drainlayer, two bricklayers, four labourers and electricians into the area to begin reconstruction work. At this time also, the Army agreed to provide a field kitchen for the contractors in the Inangahua area.

On Tuesday 28 May, 1968 the Prime Minister issued instructions to an ad hoc inter-Departmental committee of Permanent Heads of Departments involved in the reconstruction of Inangahua[1] with the following decree:

> "The object of this committee is to ensure that the fastest and most efficient use is made of all available resources to get the West Coast back to normal".

Two sub-committees were set up, the welfare sub-committee, and the sub-committee for physical reconstruction of earthquake damage. These committees were to oversee the work of the various agencies and contractors involved in the reconstruction and to determine the nature and extent of additional assistance from outside the affected area. Owing to the severity of the damage suffered at Inangahua township, this area was treated as a special case for reconstruction and was thus given priority.[2] Arrangements were made by the District Commissioner of Works to bring into the area a construction force of about 50 men made available by the Canterbury Master Builders Association. It was envisaged that after this construction team began operating, a further team would be brought in to speed up the restoration work. By the end of Tuesday 28 May, 1968, 35 of the houses in the area had been inspected, and 25 percent of these were classified as completely written-off, all of the others were damaged. By this time also, the Army kitchen was working in the area, providing meals for the reconstruction teams.

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[1] Department of Social Welfare, Treasury Department, State Advances Office, Ministry of Civil Defence, Earthquake and War Damage Commission, Department of Health, Forestry Service, Railway Department, Post Office, Police Department, Electricity Department, Department of Education, and the Ministry of Works.

[2] It should be remembered that this study is involved only with the earthquake as it affected the township of Inangahua and its residents. The effect of the earthquake on Reefton, Hokitika, Greymouth, Westport, Nelson and their hinterlands has not been considered.

Before reconstruction could begin on private homes, the Earthquake and War Damage Commission assessors had to review the premises and come to a decision about the monetary value of the house and the estimated cost of restoration. The damaged contents of the house had to be valued as well. This involved problems because the women were not allowed into the area until June 3, 1968, so consequently no private houses were restored for some time. Added to this problem was the burden of having to clear the houses of all furniture that was salvageable, and store it. Then the house had to be cleaned of debris, which had to be accounted for in order to be reimbursed by insurance. The contractor (initially the Ministry of Works) then inspected the damaged house and priced the cost of reconstruction. Because most of the private homes were let out to subcontractors to restore, the subcontractor also had to price the house. In many cases, following the subcontractors pricing, the tenders were too high, thus negotiations had to be carried out before a compromise price was accepted by the Ministry of Works and the subcontractor. As a result, it was not until 18 June 1968, 26 days after impact, that the first building firm began work on the first contract for the restoration of private homes in Inangahua.

Insurance assessment of damaged houses and other buildings proved difficult because there was trouble in separating earthquake damage from deferred maintenance. Most buildings in the area were substandard, thus the indemnity values were less than the sums insured, and much less than reinstatement costs. Added to this was the isolation of the impact area which caused the cost of repairs to be high because of transport costs and the accommodation of contractors. In essence, it meant that if the owner of a private dwelling wanted his house restored, he would have to find additional money apart from that obtained from the Earthquake and War Damage Commission. On 26 June 1968, the Minister of Housing announced that State Advances loans would be made to owners who needed assistance to meet the difference between insurance money and the cost of reconstruction. These loans were to be on normal terms and advances of up to $400 were available, subject to means test.

It soon became obvious though, that the Prime Minister's statement that nothing would be spared to bring the West Coast back to normal was misunderstood by the people of the region, the local authorities and the Government Departments involved. The impression was that finance would be made available quite liberally for all welfare and reconstruction needs, and much activity was started on this assumption. However, it became clear that no general fund of money was available, thus the scale of activities had to be reduced and any hopes of sweeping activity to counteract the earthquakes effects were abandoned. This caused much local disillusionment amongst the people and also undermined what confidence the local authorities had to handle the situation because they had assumed that central government was taking overall responsibility. It was not made entirely clear where the responsibility lay for the financing of restoration and reconstruction of the earthquake-devastated region.[1] In the Municipal Corporations Act 1954, the responsibility of land and properties damaged by floods, landslides, earthquakes, erosion and other similar hazards, is on the owner of that land, whether the owner is a private individual, a local authority, or the Crown (Section 369A). The private owner may apply for a loan, or a grant if it can be proved that the owner is not in a financial position to repay the money lent, to restore the land. According to the Municipal Corporations Act 1954, local authorities are assumed to have money reserves available in case of emergencies such as natural disasters. If the disaster is of such a magnitude (or if the local authority has no reserves of money to immediately pay for the damage) that the local authority cannot bear the full amount of the cost of restoration, then, under the Civil Defence Act 1969 (Section 46), the local authority may, with the consent of the Minister of Finance, borrow money from its bankers by way of an overdraft. Thus, it seems as if the restoration of an area is the responsibility of the local authorities. In reality though, the local authorities can apply to the central

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[1] A similar situation has manifested itself in 1979, at Dunedin in the suburb of Abbotsford, where problems have developed over whose responsibility it is to finance the restoration of the landslide area that destroyed or endangered 69 private homes. The national Government has so far not made any statement that finance will be given from the Treasury to assist in restoration, apart from the dollar-for-dollar subsidy it has granted in relation to the public donations received. At present, the Green Island Borough, where Abbotsford is situated, is faced with a million dollar restoration bill which it is incapable of honouring from its revenue. As a result of the Abbotsford landlside, and as a result of the overall confusion inherent in the Government Statutes and Acts relating to disaster relief, the Ministry of Civil Defence and the Treasury Department are at present (October 1979) attempting to restructure the legislation concerning payment of restoration after disaster.

government for financial assistance in the form of a grant or financial relief aid. How this financial assistance is determined is more a matter of circumstance than policy. It was this aspect, the government aid, that was the root of the problem in financing the Inangahua earthquake restoration. The Prime Minister's announcement suggested that the central government was going to grant financial aid to the region, but this was not the case.

In addition to these regulations, if a Government Department becomes involved in disaster-related activities, the costs incurred during this involvement are paid from the revenue made available by the Treasury in the Treasury's annual vote of revenue to that Department. This sometimes has the effect of the Head of a government department being reluctant to assist in disaster relief because his administrators have to re-allocate finite resources that have usually been ear-marked for other activities.

Because the Ministry of Works was placed in charge of overseeing the restoration, and because the Prime Minister had stated that nothing would be spared to bring the West Coast back to normal, the implication made by the local authorities was that central government was going to free funds from the Treasury to aid in the disaster recovery. In the end, however, restoration was financed by the local authorities and the various government departments involved who re-allocated their annual vote of money from the Treasury to the Inangahua-West Coast region.

Despite such drawbacks, progress on the restoration of Inangahua township was "satisfactory".[1] On 12 June 1968, a tentative scheme was suggested by the Town and Country Planning Officer who had recently visited the township. In general it was accepted that the Junction was under a serious threat from slips and it seemed obvious at that time to think of re-zoning the whole Inangahua township. The idea was accepted to consolidate the township at the Camp site. Negotiations were undertaken to consider financial settlement for those not wishing to settle in the Camp area who had previously resided at the Junction. A decision was made to relocate the Post Office at the Junction to the Camp because of the threat of inundation by slips. On the assumption that the Camp will become the new township, an impression was gained that there would be a shortage of occupiable houses. Suggestions were offered for the purchase, restoration and transfer of vacant houses from the Railway and private home-owners at the Junction to the Camp. On 4 July, 1968 the Earthquake and War Damage Commission investigation branch confirmed a report by their insurance assessor in the area that five properties, including the Junction Hotel and the Tearooms, would not be worth repairing on their present site. They were consequently pulled down.

Restoration at Inangahua was hampered in the first few months, although progress was still considered satisfactory, because of the weather: the intense cold and rainy conditions slowed progress and this was exacerbated by the slow delivery

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[1]Ministry of Works files.

of contractors supplies. A total of 105 buildings were involved and inspected in the Inangahua area. Thirty-two of these were farm buildings, 20 were Departmental houses, two churches, a school, a hotel, two shops, a Post Office, a garage, Railway station, N.Z.E.D. and M.O.W. outbuildings, and the rest being private houses. By 18 July, 1968 contracts had been let and were in progress on ten government houses, one shop and one motel. Sixteen private buildings were repaired by private arrangements; 14 of the buildings belonging to the Government were being repaired by the Departments concerned. Eighteen buildings in the area were considered unworthy of restoration.

Negotiations were proceeding on the remaining 45 buildings which had all been inspected and scheduled for restoration. Contractors' prices had been obtained for most of them and the remainder would be priced within the week of 8 July 1968. It was recommended that no re-building should be carried out at the Junction site.

On 17 July, 1968, the Welfare Section of the Civil Defence closed down. From 24 May, 1968 to this period the Welfare Division of Civil Defence had arranged accommodation for 283 people from the impact area, had provided a clearing house for the huge amounts of clothing and food parcels that were sent from all over the country to the earthquake victims, had aided as a clearing house for the distribution of all sorts of items required by the evacuees during their stay away from their own homes, and had issued cash to those in need of it.

By the end of July 1968 the completion of some houses meant that the occupants would be able to return at the beginning of August. By the second week in August 1968, the situation in Inangahua was such that there was complete restoration of four N.Z.E.D. houses, three of the six Railway houses were repaired (the other three were not required any more by the Railway Department nor by private claimants and would be put up for tender), three M.O.W. houses were occupied, two of their departmental houses were abandoned. Of the 48 private houses, eight new houses had been built, two houses had been moved to new sites, 24 tenders had been arranged and work was proceeding. No action was taken on nine houses because of difficulty of road access. In the non-residential category, 10 tenders had been arranged and work had commenced on restoration. There were four building contractors in the area. Progress was slow, mainly attributable to poor weather conditions and the availability of materials and supplies.

By September, what restoration was still remaining to be done was not considered urgent. Urgent repair on domestic chimneys in particular had been completed (which was essential because most of the houses in this area relied on coal fires for cooking and heating of water and rooms), although there was still more work to be done. Restoration was progressing at a "reasonable" pace[1] and it was considered that all restoration would be virtually completed by the New Year.

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[1]Ministry of Works files

Thus, by September the Inangahua Camp area was steadily getting back to 'normal' with the garage, store, motel, churches, Post Office and Hall all restored and able to provide the appropriate services to the township. The N.Z.E.D., M.O.W. and Education Department houses were all re-occupied and other residents had returned, although only a few of the buildings were fully completed.[1] The Primary School re-opened on 2 September, 1968. From the beginning of June to September, when the Primary School re-opened, the children were educated at the other schools. Those whose families had been evacuated to Reefton and were housed in Reefton until such time as their own homes in Inangahua were repaired, attended either the Reefton Primary School or the Reefton Convent School. Those whose families remained on their properties in the district (some of the farming families in the Inangahua Landing-Brown Creeks Road area) or who were living near Cronadun, attended the Cronadun Primary School. There were also some families who moved away temporarily from the district. The children in these families attended whatever school was in the district where they were located. Other children were sent to stay with relatives in other parts of the country while their parents stayed in the district to repair their houses.

Some families did not return to Inangahua after the earthquake. How many moved away permanently is not known for sure, but the Inangahua Primary School roll was reduced by 57 per cent from February 1968 to December 1968.

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[1] There was still a refugee family occupying a house rented from the Civil Defence at Reefton in November, 1968.

By the end of 1968, seven months after the earthquake struck the town, Inangahua had recovered sufficiently from the impact for a veneer of 'normalcy' to cover the area. All the roads had been cleared, levelled and sealed, the railway lines had been reinstated, so had the Railway Station, bridge approaches were built up and bridges were restored to pre-earthquake safety levels, telephone and commercial radio communication was re-established, and the economic activities of the township were back to active levels.[1] The school had re-opened, farms were re-occupied and their owners were pursuing farming routines whilst reinstating fences, stock numbers, machinery and outbuildings. The majority of houses were once more occupied and families were able to conduct their social lives within the boundaries established prior to the earthquake.

Most of the people returned to their former homes and rebuilt their lives from the ruins of Inangahua township. For the 283 people from the Inangahua area who had been billeted in Reefton, some of them for periods of up to six months, the last few months had been a time of trying to re-build their lives. Unable to get back to their own accustomed ways of life, being billeted with strangers who they had met for the first time on the Friday of the earthquake or the day after, trying to gather what possessions they had left, they were faced with a situation of having to plan for

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[1]That is, those economic activities that were re-activated and survived the earthquake. The Hotel, the Tearooms and two sawmills closed down as a result of the earthquake's occurrence.

the future, whether they should return to Inangahua, or whether they should move further afield and establish their lives and livelihood somewhere else.

For some Inangahua residents a decision was made not to return to the township. Some of them based this decision on economic factors; their jobs had gone, or their homes were damaged to such an extent that it would have cost more to re-build the dwelling than it would to build anew. Others moved because members of the family refused to go back to Inangahua where they might be the victims of future earthquakes. But the majority did return. Summing up the effects of the earth-quake and philosophising on mans' stoicism, one respondent concluded:

> "I think it is part of the tragedy and part of man's triumph over nature that people are going to go back and pick up their broken pieces and say, 'Well, its happened to us, now lets get going again', and roll up their sleeves and get stuck in once again to the business of living".

> "No matter how we are compensated for our losses during this period, it is not going to replace the sentimental value of wedding presents or gifts that we had been given over the years, or little treasures we had gathered about us. Things that have a personal significance in our lives. These can never be replaced because they are usually bought at a certain time or periods in one's life which is now passed and perhaps served as momentos of this time in your life. It is though you have to start off building once again half-way through your life".

(May 24, 1968 Inangahua)

TABLE VII

COST ACCRUED FROM THE 1968 INANGAHUA EARTHQUAKE

	$NZ
Salvation Army cheque for immediate relief+	1,000
Westport cost to repair 25 septic tanks	3,000
Westport North Beach area damage to sewers	7,320
Westport Damage to another 61 properties	7,320
Westport 200 properties not covered by insurance	21,000
Inangahua substation restoration of four houses	6,000
Helicopters (N.Z.) Ltd.	400
County Roads cost estimate	12,650
Hokitika Council staff expenditure	992
Government grant to earthquake Disaster Appeal Fund+	10,000
Evaluation and rescue work in Inangahua	6,090
Emergency clothing etc.	2,090
Securing houses used by evacuees	3,010
Food for families and Civil Defence squads	1,440
Emergency demolition	9,700
Emergency plumbing	1,170
Communications	630
Inangahua County Council staff overtime	350
Freight of Indian tea (Gift from Indian Government)	50
Local authority grant	8,340
Inangahua restoration (as from 17 August 1968)	60,619
Westport Catchment Board Loan	4,200
Greymouth Town Clerk's Office estimation	1,032
Ministry of Works work for Earthquake and War Damage Commission	5,290
Inangahua earthquake appeal fund addition+	7,998
National Roads Board expenditure	838,803
Reefton Town Clerk's office	1,007
Plant used in Reefton	919
Westport damage Ministry of Works estimate	25,000
New Zealand Railways	474,516
Education Department	121,000
Electricity Department	77,332
State Advances Corporation	53,300
Internal Affairs Department	24,156
Earthquake and War Damage Commission Claims Cost	2,500,000
TOTAL*	4,298,986

+Donations were considered as costs because this money had to be diverted for use in this crisis from other possible areas of expenditure.

*Bligh estimates that cost of the Inangahua earthquake is $4,198,708 (Britton 1979).

CHAPTER VI

REFLECTIONS ON THE POWELL AND RAYNER MODEL OF DISASTER TIME

The concluding Chapter will focus attention on Powell and Rayner's model by assessing the applicability of the model as an analytic tool for the study of time periods and collective behavioural responses in disaster situations. This Chapter will also comment on the suitability of the model in the analysis of earthquake-induced disasters, in particular, the 1968 Inangahua earthquake. In the presentation of this material, the chapter will be divided into four sections:

6.1 Problems of applying the model to the Inangahua earthquake.

6.2 The limitations of the Powell and Rayner model.

6.3 The strengths of the Powell and Rayner model.

6.4 Application of the model to earthquakes.

6.1 Problems of Applying the Model

(1) No Warning/Threat Stages

There are two types of disaster situations which can be identified on the basis of:

a) hazard perception (whether or not the disaster agent is identified before impact) and,

b) the presence or absence of consequent activities based upon the perception of the hazard.

The first type of situation, based on the identification of the hazard before impact, can be termed 'anticipated disaster'. In this, the identification of a potentially hazardous situation has been recognized either by the authorities (for example, the Meteorological Service monitoring a cyclone advancing towards a population area, as illustrated by Wallace (1956), or by the people living in the area of the hazard (for example, in the Dunedin hill suburb of Abbotsford in 1979): two residents of Mitchell Street noticed cracking and slumping of their properties ten weeks before a landslide tore the hill apart. Twenty houses were wrecked when they fell into a chasm created by the land movement and over forty houses were considered unsafe for habitation because of their proximity to the chasm. The cracking and subsidence was monitored by the residents who informed the Green Island Borough Council (an area of Dunedin) and engineering consultants. Two days before the landslide the Civil Defence declared the area an 'emergency disaster area' and set in motion plans to evacuate the residents).

In an anticipated disaster, Powell and Rayner's 'disaster time' model and its seven stages can be identified, beginning with the 'Warning' stage. The hazard has been acknowledged by authorities or the people living in the region, and action can be initiated to mitigate the impact of the disaster.

The second type of disaster situation can be termed an 'unanticipated' or a 'precipitate' disaster, whereby the disaster agent and the consequent impact of the hazard on the community is unexpected. In this type of disaster there is no awareness by the authorities or the people living in the area that a disaster is imminent. In this type of disaster situation the first two 'disaster time periods' of the Powell and Rayner model (that is, the 'Warning' and 'Threat') are absent. The perception of a disaster situation begins with the impact of the disaster agent on the populated area. The Inangahua earthquake of 24 May 1968 is an example of the second type of disaster situation. Earthquakes are examples of 'unanticipated' or 'precipitate' disasters.

The problem of placing the Inangahua earthquake within the context of the model established by Powell and Rayner is that there is no warning or threat stages. Powell and Rayner's model is therefore inappropriate to a 'precipitate' disaster if the total time dimension of the model is viewed as a 'normal' genesis of a disaster situation. The suggestion put forward in Chapter III of this study is that for situations like earthquakes, flash-floods, for many man-made disasters (for example, the Halifax explosion described by Prince (1920)), and other 'precipitate' disasters, a 'bolt-from-the-blue' model of disaster time needs to be developed. Although this bolt-from-the-blue situation has been criticised as being an atypical disaster situation (particularly by Turner (1976) and Kastenbaum (1974) who coined the bolt-from-the-blue usage in disaster models), it is appropriate for certain circumstances and for certain disaster types, and it should be acknowledged that disasters do not always have warnings or threat phases. It is recognised by students of disaster research that there are many situations in which knowledge of an impending disaster is absent, but as the table from Stoddard shows (Figure 13),most Time models used in disaster research assume awareness preceding disaster.

(2) Problems of Obtaining Precise Information from Disaster Victims During Impact and Inventory

Powell and Rayner state that each stage of development in disasters have 'characteristic patterns of behaviour, feelings and stress (1952:1), and each stage is 'characterised by significantly different phases of behaviour as well as subjective experience' (1952:2). The model developed by these two researchers, and the replication of that model in situations of disaster is dependent on an accurate record of the disaster victims behaviour and activities within the period of the emergency.

One of the problems faced in the research undertaken on the 24th May 1968 Inangahua earthquake is precisely that of obtaining an accurate reconstruction of the respondents behaviour and actions to the events caused by the earthquake. Three factors underlie the problem of obtaining an accurate record of the Inangahua earthquake. The first is that an event that is totally unanticipated and unfamiliar to the participant, and in an event which the participant views as a threat to his survival (as was the case in the Inangahua earthquake), a situation can exist in which the participant may not register fully the events happening around him/her and the activities which he/she undertakes during the impact

Selected Time Models used in Disaster Research

Carr	Drayer	Smith	Form	Williams	Powell et. al.	Wallace	Ellemers	Stoddard
		Preparation and Training	Pre-Disaster Phase	Adjustive Phase	Pre-Disaster Conditions	Steady State		Pre-Emergency Phase
Preliminary or Pro-dromal Period					Warning		Warning	Emergency Phase -Warning
				Protective Phase		Warning and Threat		
	Pre-Impact		Pre-Emergency Phase		Threat		Threat	-Threat and Evacuation Stage
------------	--- Impact ---	Threat or Impact ---- (Mass Care)	Emergency Phase -----	Impact Phase ------	Impact ---	-Impact -----	-Impact----	-Dislocation Stage ----
Dislocation and Disorganization Phase			-Period I	Survival Phase	Inventory	Isolation		
			-Period II		Rescue	Rescue	Rescue	
	Post-Impact	Post-Impact (Emergency Relief)	-Period III	Remedial Phase (Recovery Period)	Remedy		Evacuation	-Relocation Stage
Readjustment and Reorganization			Post Emergency Phase	and	Recovery		Restoration	Post Emergency Phase
		Temporary Rehabilitation				Rehabilitation		-Short Term Rehabilitation
		Permanent Rehabilitation		Integrative Phase		Irreversible Change		-Long Term Rehabilitation

FIGURE 13: SELECTED TIME MODELS USED IN DISASTER RESEARCH

Source: Stoddard E.R.: CONCEPTUAL MODELS OF HUMAN BEHAVIOUR IN DISASTER (Texas Western Press) 1968:11

of the disaster agent. This can also be the case in the period immediately following impact. It may be very difficult to objectively recall the chronological sequence of events during the impact and inventory periods. The problem, then, is one of being able to reconstruct accurately a unique and frightening experience.

Fritz states that an instantaneous disaster tends to produce the maximum social and psychological disruption (1957:7). It may be too much to expect an individual to accurately recall what he/she experienced in a disaster situation to the extent that will satisfy the demands and rigor of the Powell and Rayner model. The researcher may have to be satisfied with a general recollection of some events or characteristics of the disaster. This may mean that adequate data cannot be obtained to satisfactorily place the behaviour into different stages of disaster.

This problem is exacerbated by the second factor: the length of time between the disaster event and the time when the researcher interviews the respondents about the disaster. In the study undertaken on the 1968 Inangahua earthquake, research was started in 1977 - nine years after the event had occurred (it was ten years after the earthquake that interviews were begun with residents of the Inangahua township). This posed problems because the researcher was entirely dependent on the ability of the respondents to recall events that occurred a decade ago with the degree of precision that Powell and Rayner's model requires. This problem has already been noted earlier in this study (refer Chapter IV), and further elaboration would therefore be a duplication.

The third factor underlying the problems in obtaining an accurate record of events in a disaster situation is an outcome of the two problems mentioned above. If the respondent cannot recall clearly the sequence of events as he experienced them because of psychological disruption (Fritz 1957:7), and if there is considerable time intervals between the event in question and the time the interviewer collects data from the respondents about the disaster, there is a probability that the knowledge internalized by the respondent about the disaster and the consequent information he/she gives to the researcher is not one based entirely on the respondent's own experiences but on the information that has been augmented by the shared experiences of others who were also in the same event. In other words, there is a diffusion of knowledge between the participants of the disaster about what happened. What others did or experienced may become incorporated into what the individual thought he/she saw or experienced. The researcher then has the additional problem of trying to extract the individuals own private experience that may be supplemented by the general knowledge of the group which is based on consensus.

(3) Inventory Period Applies only to the Impact Area

Powell and Rayner characterise the Inventory Period as one of stock-taking and re-orientation towards action (1952:4). Powell develops this period, describing inventory as a 'peculiarly intra-personal stage' (1954: II 8), that is, one of personal re-adjustment to the new environment, of regaining awareness, of taking stock. Inventory also consists of a collective public recognition of what has happened after impact (Powell 1954: II 9). The inventory period developed by Powell and Rayner refers only to the area impacted by the disaster agent, that is, the area which Wallace calls the Total Impact Area (1956:3).

It was suggested in the preceding chapter that it is useful to regard the inventory period not only as a phase affecting the Total Impact Area, but as a phase extending to the other disaster space areas proposed by Wallace. In order to facilitate this extension, the meaning of Inventory will have to be broadened. It is important to realise that the area outside the impact zone has to become aware of what has happened - in Powell and Rayner's terms, 'to take stock of the situation and the circumstances that have occurred' (1952:3). If there is no awareness by the outside area that a disaster agent has struck a populated area then there can be no help or aid coming from the unaffected population, hence there can be no Remedy Period as defined by Powell and Rayner, and the Recovery Period would be considerably delayed in developing the characteristics given to that period by Powell and Rayner. Presumably too, the recovery period would also be prolonged over a greater time period. Indeed, the recovery period may not eventuate; if the impact area had no aid from outside, the sequence of disaster time could conceivably move from Impact to Inventory to Rescue to Irreversible Change.

Implicit in Powell and Rayner's model is the assumption that areas outside and adjacent to the impacted area (as defined by Wallace 1956:3) are aware that a disaster has occurred and that the area of occurrence is known. This assumption should not be taken as a known fact in all situations where a disaster has occurred. As illustrated in the 1968 Inangahua earthquake, neither the recognition by populated areas external to the impact area that a disaster had occurred, nor the recognition that the disaster area was known can be taken for granted. It is suggested then, that the model be extended to include within the Inventory period an 'Awareness Phase' that takes account of the possibility that people in areas outside the impact zone have to 'learn' that a disaster has taken place and where it has occurred. This 'Awareness Phase' may necessitate an elaboration of the definition of Inventory to include the idea that inventory also implies the

> perception that a disaster has occurred by a population outside the impact area who are in a position, once they are aware where the disaster has occurred, to provide aid and relief to the population of the impact area.

The 'Awareness Phase' would only apply to those disasters which are unanticipated. In anticipated disasters, that is, those with a warning and a threat phase, the disaster agent would be monitored by agencies and the population that is likely to be affected by the disaster agent. There is thus a greater likelihood of information about the perceived impending disaster situation being disseminated. This dissemination of information about a perceived threat could be received by people outside the assumed affected area, and would therefore create an awareness of the possible danger and the location of the assumed impact area. In terms of Merton's concepts of 'manifest' and 'latent' functions, the manifest function of disseminating information about an expected or anticipated disaster situation is to inform the people in the perceived affected area of the threat, thus enabling those people to prepare for the disaster. The latent function of the dissemination of the information of an expected disaster is the creation of awareness by those in the greater non-affected area that there may be a disaster in the near future; the disaster agent and the anticipated location of that disaster is made available so that when the disaster has occurred, the source and location is known, thus the time between impact and the arrival of outside aid/relief is reduced.

Powell and Rayner's assumption that the impact area is known to those outside the affected area can be correct only if information from some source is available. The dissemination of such information is present in an anticipated disaster and is absent in an unanticipated disaster.

(4) <u>Problem of Regarding the Impact Area as a Zone in which Activity is Universal</u> (i.e. that events and behaviour during the emergency states are the same throughout the affected area).

Powell and Rayner, in their model of Disaster Time, imply that the impact area is a discrete and united social unit.

Their definition of community can be regarded as belonging to the structured dimension of community, that is, the community as a physically bounded locality (refer Chapter V Inventory Section). They do not consider that a community can consist of sub-communities in which the people within them may act differently (from each other) in time of threat or impact from a disaster.

In the pre-impact period, Inangahua was composed of three geographically distinct areas, yet these areas were combined socially to form one united community in terms of the residents social construction of the town. These three areas were Inangahua Junction, Inangahua Camp and the immediate hinterland comprising approximately 30 farmhouses. The earthquake produced a restructuring of the Inangahua community into three distinct territorial units, whereupon the community of sentiment, characterised in the three areas before the impact, was temporarily ruptured.

Thus the problem in studying Inangahua was one of researching the effect of the impact and inventory phases on three sub-communities that were a creation of the earthquake.

(5) <u>Problem of Regarding the Rescue Period as a Universal Period with Respect to the Time of Commencement and the Activities Undertaken within the Total Impact Area</u>.

If, as a result of the disaster agent, the impact area is divided into territorially distinct sub-communities, then it is appropriate to consider that the period of rescue will differ from one sub-community to another in terms of:

1) the kind of activities undertaken, and,
2) when these activities were begun by the disaster victims.

Each sub-community can be looked at as a distinct impact area and within each of the impact areas, Powell and Rayner's model of disaster time can be applied. For instance, in the 1968 Inangahua earthquake, the people in the Camp area recovered more quickly than the Junction residents, thus the inventory period was lessened and the rescue phase began earlier in the Camp. The activities performed by the members of the Camp area were different from those in the Junction (for details refer previous Chapter).

The Powell and Rayner model makes no provision for there being any more than one impact area in a disaster situation and, therefore, there is no provision for the impacted population to commence rescue activities at different times. This assumption differs from the empirical evidence obtained in the study of the 1968 Inangahua earthquake, where it was established that the township of Inangahua was divided into three sub-communities as a result of the earthquake, and that the activities and behaviour of the inhabitants of these sub-communities could not be placed effectively into one single period of rescue. In order to apply the model to this particular disaster, each subcommunity had to be studied independently and the different periods of disaster time had to be employed in each of the subcommunities.

The assumption that underlies Powell and Rayner's model that disaster victims in an impact area will exhibit feelings and activities that are consistent on a temporal dimension throughout the impact area may therefore be wrong.

(6) <u>Problem of Assuming there are Universal Characteristics in a Disaster Situation and Basing a Disaster Time Period on those Characteristics</u>.

Powell expands the original definition of the rescue period (Powell and Rayner 1952:4) and describes the rescue period as being

> "..marked by a period of utter confusion; the wanderers and the screamers among the impact victims; the inrush of curious and appalled from the fringe; the hasty searches by individuals, most of these being parents who were not in the impact area but who rush in there to find their families; the crowds of inactive spectators".
>
> (1954: II 10)

The rescue stage

> "..also includes precautionary activity against secondary threats such as electrocution from fallen wires, fire from escaping gas, etc.
>
> (1954: II 10)

These are the characteristics which, when present, establish the beginning of the rescue period. Other characteristics of this period are

> "<u>The self extrication of the survivors and rescue of protective activity by the impact zone population itself</u>".
>
> (Powell and Rayner 1952:4; Powell 1954: II 9)

In the elaboration of the rescue period, Powell introduces characteristics which he assumes are typical of all disaster situations but which are clearly not apparent in

May 24 1968 earthquake at Inangahua. The problem develops when the researcher tries to base analysis of the rescue period on the features that Powell describes as being universal in disasters. If, for example: (a) there were no trapped victims immediately known by the survivors in the impact area, and if there were no secondary threats such as houses burning, escaping gas, fallen live wires that were endangering the lives of survivors, necessitating immediate action by those survivors, and (b) if the impact area was physically isolated from other populated centres so that the 'inrush of curious and appalled from the fringe' could not occur for some considerable time (assuming that the impact zone was known by those outside the impact area)[1], then the beginning of the rescue period may become problematic for the researcher who bases his time periods on the characteristics described by Powell.

The characteristics of the disaster time that are underlined (page 250) provide a better definition of the rescue period because the level of generality is such in this definition that it allows each disaster situation to portray specific peculiarities (for example, whether or not there are secondary threats, or an inrush of people from the fringe) and does not circumscribe the disaster time period by characteristics that may not be present. Yet, this underlined definition still explains the actions of the disaster victims in a manner that differentiates the actions within this period from that of other periods of disaster time.

[1]All of these characteristics were present in the Inangahua earthquake situation.

(7) Problem of Interpretation of the Recovery Period

Powell's development of the recovery period as

> "...the resumption of normal functions, of responsibility for self-help, and the slow trek back to the status quo ante or a reasonable facsimilie of it"
>
> (1954:II 12)

is problematic when this definition is applied to a disaster situation. The argument on this problem has been developed in the previous Chapter (see The Post Emergency Period: Recovery), but it will be summarised below. The three criteria that Powell uses to define the recovery period are not compatible to explain the activities and processes that occur after the remedy period. The problem can be viewed from two perspectives, one with reference to the general application of the recovery period as defined by Powell, to all disaster situations, and secondly, with reference to the Inangahua earthquake of 1968.

With respect to the first perspective, the application of the recovery period based on the criterion of the 'resumption of normal functions' within the overall context of disaster research, requires a careful understanding of the implication of this phrase. The 'resumption of normal functions' implies that the established social structures, institutions, procedures, processes and interacting pursuits that are common to a given society or community are once more present. 'Resumption' implies a 'carrying on'; it suggests that a halt in the proceedings has occurred, but now the conditions that were typical of that community are once again established. This interpretation may not follow with chronological regularity from the previous disaster time (remedy), as shown by the Inangahua earthquake, thus a refining of the model in terms of incorporating another time-period that bridges the interval between remedy and recovery as it has been interpreted above needs to be attempted, or in terms of redefining the period of recovery so that the actions and processes that follow the remedy period can be incorporated into the recovery period.

With reference to the Inangahua earthquake, Powell's 'responsibility for self-help' introduces problems of using this as a criteria for the recovery period. Again, this criteria creates an interval between the remedy period and the time when the responsibility of self-help was achieved. This interval was caused by the total evacuation of the inhabitants of Inangahua after the earthquake of 24 May 1968 until 19 June 1968, when all restrictions were lifted, thereby allowing women and children to return to their homes in the impact area on a permanent basis. This ability to perform self-help by the residents was restricted until they were allowed into the region permanently, and they were not permitted to do this until the area had been made habitable and reconstruction/restoration had taken place; activities that were carried out in the main by building firms under contract to various Government departments involved in the restoration of Inangahua.

The development of the recovery period as Powell has defined it leads to the confusion of when this period in the stage of disaster reconstruction takes place. The clarification of recovery warrants attention by researchers using this model.

6.2 Limitations of the Powell and Rayner Model

> Man proposes a system of hypotheses; Nature disposes of its truth or falsity. Man invents a scientific system and then discovers whether or not it accords with observed fact.
>
> R.B. Braithwaite, Scientific Explanation

(1) Situational Reference

A nine-fold typology for evaluating existing disaster models was devised by Chapman (in Baker and Chapman 1962:306). Utilizing Chapman's typology, a model for disaster research can be characterised by its position along the situational-individual continuum, that is, whether the model is intended to be a workable construct of the situation in which people find themselves in at the time of disaster, which is almost a completely physical description of the situation (Chapman 1962:309)[1], or whether the model is essentially an interpretation of the behaviour of an individual within these given situations.[2]

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[1] For example, stating the nature of an earthquake and the important physical effects of destruction and injury to be expected under the circumstances. Haas' scenarios for earthquake prediction are examples of this (refer Haas and Miletti 1977).

[2] This type of model may, for example, focus only on how people react to direct personal injury, or how individuals react to the social changes that occur during a disaster.

Models of disaster that have been developed so far in the field of disaster research can be placed somewhere along the situational-individual continuum. Because these models are able to be placed along the continuum, it means that no one model has been devised which can account for all disaster behaviour that can be observed, or the conditions in which the behaviour has developed. This means that models used in disaster research at present are useful only for the analysis of some behaviour within the disaster; they do not cover the complete spectrum of activities and behaviour of individuals, groups of individuals, or the total affected population; or else are useful for a physical description of the disaster. Models available to the researcher at present are capable then, of providing frameworks for the partial explanation of the total consequences of the disaster under study. For a researcher to study the full effects of a disaster-agent upon a community, he needs to refer to several models that are placed along the situational-individual continuum.

The Powell and Rayner model of disaster time is an example of a model that offers partial explanations of the behaviour to be found within a disaster-impacted community. This model's emphasis is an attempt to explain collective behaviour in disasters. Collective behaviour here is studied by breaking down the disaster into time periods, each period of disaster time is stated to have characteristic activities that are undertaken by the victims of the disaster-agent. Because the emphasis is on collective behaviour and the collective response of the impact population, this model falls between the middle of the continuum and the individual 'end' of the continuum. Powell and Rayner's model cannot be used successfully for explanations of individual reactions to specific incidents that may occur within the overall context of a disaster, nor can it be used to describe the physical effects that a disaster agent brings upon the material structure of the impacted community. It is useful, however, as an explanation of the stages by which a disaster population reacts to the changed social environment and organises the members of the impact area to repair the devastation. It also offers an explanation (although limited to certain conditions - refer Chapter VI Section A, Part 3), of how outsiders assist in a disaster situation. As well as providing an explanation for the collective behaviour of the population at risk in an impending disaster, and the collective actions of people in a period of impact, some of the disaster time periods of Powell and Rayner's model can be used to illustrate individual responses to a disaster situation (for example, the threat, impact, inventory and rescue periods).

Powell and Rayner's model then, is a useful tool for providing the researcher with a framework in which to place collective, and in some cases, individual responses to a disaster situation. This model, however, is only a partial explanation of the overall behaviour in a disaster and is not intended to offer a description of the physical effect of a disaster, or to be used as a device for studying individual reactions to specific aspects that occur in a disaster.

(2) Level of Abstraction

Following again on Chapman's analysis of the dimensions of models (1962:312), the lack of specificity of Powell and Rayner's model is a limitation for the application of that model to the real-life disaster situation. Although the model may be relevant to the analysis of disaster situations, it may not be discriminate with respect to the specific disaster situation under study: in other words, although the terms of the model correspond to periods in which the disaster may be viewed, the disaster under study may exhibit features for which the model makes no provision. For example, Powell and Rayner's model suggests that the inhabitants of the impact area will react to the disaster and it's effects in a united way, and therefore their actions can be generalised and placed into distinct disaster periods. These disaster periods will encompass the whole impact area and the behaviour of the victims. In the 1968 Inangahua earthquake study, prior to the earthquake, Inangahua functioned as a single community in terms of Toennies 'community of sentiment', incorporating the territorally distinct areas of Inangahua Camp, Inangahua Junction, and the farmhouses surrounding the former two areas. After the earthquake, this 'community of sentiment' was restructured into three separate sub-communities, each responding to the after-effects of the earthquake in different ways (refer Chapter V). The time periods of inventory, rescue and remedy could be applied to each of the sub-communities, but could not be applied to the overall impact area without difficulty because the people in the different sub-communities reacted to the consequences of the impact on temporal dimensions that were at variance with the other sub-communities. The model does not make provision for an impact area that is divided into isolated sectors: it envisages the population in the impact area to pass through discernible time periods in an impact area that can be viewed as a single unit. The model developed by Powell and Rayner is an idealized representation of the real-world situation pertaining to disasters. Ideal types are tools for analysis, they are logical models built up by accentuating the salient features of situations that have a common basis (Shipman 1972:135), in this case the common basis is behaviour in disasters. Ideal types are not a description, but a logical deduction, an impression, not a product of actual investigation (Shipman 1972:135). Models that are ideal types are abstractions of reality, they do not purport to provide a good explanation of the particular. In fact, the weakest point of an ideal type is its ability to provide an explanation for particular situations.

Even so, an idealized model should be based on the empirical evidence of a number of diverse, yet related situations. Powell and Rayner's model is based on disaster situations (plane crash series, tornadoes) that are geographically restricted. Disaster-agents are not always confined to such restricted areas (for example, earthquakes or droughts). Because of the concentration of particular types of disaster which affect geographically confined areas, the assumption that the social behaviour portrayed within these types of disasters will be the same for more geographically dispersed disasters may be wrong. The inability of the Powell and Rayner model to acknowledge that the people in an impact area may react, not as a united social group in which case the activities and behaviour of the people involved can be seen as occurring en masse, but as a situation in which the people affected by the disaster-agent act as sub-groups, and therefore may move from one disaster period to another at different times, may be seen as portraying an unrealistic assessment of human social behaviour in disaster.

The Powell and Rayner model is a general representation of collective behaviour in disaster situations. Because it is a general representation, and because it is meant to be applicable for all major disaster-types (Powell and Rayner 1952:1), the application of the model to a specific disaster, and a specific disaster-type (e.g. earthquake), may mean that some parts of the model will not 'fit' with the real disaster situation. An example of this problem is the model's discussion of the 'Emergency Period' that precedes impact. Here, the model describes the period of warning and threat that are assumed to be present before the disaster-agent has actually struck a community or a segment of a community. These periods though, are present only in 'anticipated' disaster. Not all disaster situations are anticipated, thus not all disasters are preceded by an emergency period.

The higher the level of abstraction a model achieves, the less specific it becomes with respect to empirical behaviour that is observed in the field. The problem then becomes one of trying to place the empirical data into the framework of a model that is being used to structure the disaster situation for analytical purposes, and finding the model does not 'fit' the real world situation in the disaster studied.

(3) The Recovery Period

Powell and Rayner (1952) in the initial development of the model, and Powell (1954) in his paper which further elaborated the time periods, referred to the Recovery Period as being one in which the individual and the community reconstruct and restore the damage delivered by the disaster-agent and attempt to return to the conditions that were present before impact. This post-emergency period devised by Powell and Rayner implies that the community struck by a disaster agent will be re-built in terms of the social networks and in terms of the physical infra-structure that were established prior to the disaster, thus the community will be restored to its original condition.[1]

There have been few studies undertaken that have concentrated solely on the post-impact period of disaster (for an example, see Haas et al 1977; Germen 1978). Most researchers treat this period as an appendage to the disaster model they have devised or are employing in their analysis of a disaster situation, acknowledging that the disaster-stricken community will recover from the damage dealt by the disaster-

[1]Powell and Rayner do not take into account that social and structural change is ongoing. Because of this, a social system may never return to its previous state because the 'previous state' is but a process, a stage that is developed and these developments often have irreversible effects.

agent, with the social environment being restored to much the same as it was before the impact.[1] It is acknowledged that restoration may take a long time (Beach 1967:22) and that as the process of recovery goes forward, something much like the original social system is typically re-established. The recovery period also typically assumes that the individuals who experienced the disaster will recover from their ordeal and will re-establish their former life-styles and social networks as they were in the past, although some (e.g. Tyhurst 1951) state that this recovery may be a life-long endeavour and may be different from the original.

There is some evidence to support the contention that the original social system will be re-established. Haas _et al_ (1977: Chapter 6) states, for example, that

> "all cities rebuild...on the same site"
>
> (1977:262)

and

> "the final outcome of reconstruction following a disaster does not necessarily result in a rebuilt city that is more efficient, or is more pleasant to live in, or provides its people with access to a fuller range of services. Nor does it result in a reduction of future vulnerability".
>
> (1977:267-8)

Nevertheless, neither Haas _et al_ in their conclusions, nor Powell and Rayner in their model of disaster time make implicit the evidence established in some research (e.g.Wallace 1956) which shows that post-impact communities do not always recover fully

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[1] This may not be possible. The effect of the disaster may be a permanent force upon the community e.g. Aberfan in Wales, and Abbotsford in New Zealand.

and do not necessarily return to the former conditions that prevailed before disaster struck.

Another example of the changed equilibrium that results from disaster impact can be illustrated with reference to the 1968 Inangahua township. Prior to 24 May 1968, the population of Inangahua Camp and Inangahua Junction was estimated to be 240 persons, 40 of these living in the Junction. After the earthquake it was decided by officials from the Town and Country Planning division of the Ministry of Works that the Inangahua Junction was under serious threat from slips and was unsafe for people to live. As a consequence, the Junction area was not rebuilt. Work was undertaken in July 1968 to re-zone the Junction houses and families to the Camp site. These 40 people, representing 16.6 per cent of the Inangahua population, were advised they could not return to their former homes as they were then situated. Because of this governmental action, the buildings, which represented 22 per cent of the total buildings in the township, were either re-sited or demolished.

Thus, after the earthquake:

a) the township was reduced in size by the removal of houses and other buildings from the Junction site and consolidated at the Camp site. In 1968 the Junction comprised a Post Office, Hotel, Store, Tearooms, Transport Depot and twelve houses. In 1979 the former Junction site has the Transport Depot and four houses, representing 29 per cent of the original number of buildings in the Junction before the earthquake, and housing 32 per cent of the population that was living in this area in 1968.

b) The population of the Inangahua township was reduced from a 1968 figure of 240 residents to a 1978 figure of 135, a 43 per cent decline in the ten years.[1]

c) The economy of the area was depressed prior to the earthquake of 1968, mainly because of the decline in the coal industry in the West Coast region. Some of the men previously engaged in this industry were employed in timber milling. Employment opportunities in the region were further reduced by the closure of the two sawmills shortly after the earthquake. The hotel was abandoned, so were the tearooms. There is no doubt that the earthquake had a severe effect on the economy of the region and on the population in the area. But not all the depopulation can be attributed to the earthquake. Numbers were further reduced by such actions as the Ministry of Works reducing their activities in the region after the completion of the Lower Buller Gorge road in early 1968. After the earthquake, considerable damage was done to this section of the highway, but after repairs had been carried out, the number of M.O.W. personnel in the Inangahua township was considerably reduced.

These three examples cited from the study of the Inangahua township following a devastating earthquake in 1968

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[1]Between the years of the 1966 Census and the 1976 Census the Inangahua County statistics revealed a 30 per cent decline in population. The Inangahua County consists of Reefton, Inangahua Junction (the name given to the consolidated Camp area), and the surrounding farming homesteads. These figures illustrate that Inangahua township had declined more rapidly than Inangahua County.

help to illustrate the point that a community does not necessarily re-establish itself to the original pre-disaster situation as most disaster models assume. Wallace, in his analysis, acknowledged this weakness while applying the Powell and Rayner model to the tornado-stricken community of Worcester, United States of America. He accordingly re-named the final period of his revised disaster model as 'Irreversible Change' in recognition of the fact that after the disaster-agent had struck, the "social system has changed irreversibly" (1956:12).

Powell and Rayner's final period of disaster time needs to be re-defined to allow the model to incorporate the empirical observations that have been made which suggest that a community does not always re-establish itself along the original physical and social networks apparent before the disaster. A community can, and, as has been observed, does change from the original social system as a result of a disaster.

(4) Static Nature of the Model

The previous limitation which suggested that the Powell and Rayner model, by virtue of the fact that the recovery period implies the disaster-stricken community and its social members re-establish along the lines of the pre-impact community, introduces a further limitation: the model has a static perspective because it suggests that the disaster-agent affects a community that was in a state of equilibrium and that consequent activities (inventory, rescue, remedy, recovery) are regarded as processes directed towards bringing the social system back to the original state of equilibrium.

It is important to note that the equilibrium to which the community or individuals within that community finally adapts itself is not always the equilibrium that was present prior to the disaster. From this perspective, there emerges the concept of evolutionism (Chapman 1962:321). The pertinence of this concept is found by the evidence already stated in the 1968 Inangahua earthquake example; as a result of the earthquake, Inangahua underwent a transition from one equilibrium to a new equilibrium, the characteristics of which were different from the former. Many disaster studies note the fact that the impact of a disaster upon a community is not simply to disrupt the community's original state of equilibrium and to initiate processes which return it to its former equilibrium, but is also sometimes to induce lasting social changes in the community (for example, refer Wallace 1956; Haas _et al_ 1977; Moore 1958; Miletti _et al_ 1975). The consequence of a disaster may, therefore, be that from one system a new system is produced with its own quite different normal state.

6.3 Strengths of the Powell and Rayner Model

(1) The Model as a Framework for Analysis

Despite the limitations apparent within the model, Powell and Rayner's schemata of the periods which victims pass through as a result of a disaster situation is a very useful tool for the analysis of a disaster event. Perhaps the most useful contribution this model makes to disaster research is the application of the model as a framework for the analysis of the events and behaviour within those events. The utilization of time models (i.e. an ordered sequence of events) allows the researcher to give a more accurate account of experiences and attitudes as they sequentially occurred. The importance of using time models in disaster research cannot be overemphasised. Stoddard suggests

> "Without distinct temporal categories to limit the general application of basic behavioural principles to all time periods during a crisis situation, numerous erroneous inferences can be made".
>
> (1968:9)

Stoddard also states that a chronological classification helps to isolate those factors directly responsible for bringing about present attitudes and situations (1968:9).

Powell and Rayner's periods of disaster time have been found to describe typical behaviour in the context of a crisis situation and their usefulness as a basis for suggesting the types of collective behaviour and activities during a time of disaster has been great enough to have brought about this time-schema, or minor variations of it, into general acceptance. Their model has sought to establish a framework permitting a comparison between disasters in terms of the stages or time-periods through which the disaster passes. The seven stages - warning, threat, impact, inventory, rescue, remedy, recovery - are used to construct a profile of disasters which can be related to individual and group responses to disaster.

(2) Comprehensiveness

Like all social science research, disaster research models may attempt to explain a great deal of what happens, or it may restrict its explanations to some particular facet of the situation which is nevertheless in itself important. Powell and Rayner have constructed a model of disaster behaviour which purports to explain the many phases of a disaster and the behaviours that occur in those phases. This model then, is an attempt to provide a comprehensive coverage of the disaster event by dividing the total disaster period into seven distinct stages, each stage of the disaster illustrating behaviour that corresponds to one time period which is not appropriate or apparent with any regularity for any other time phase.

The utility of the Powell and Rayner model lies in its ability to provide an overall framework of a disaster situation within which the observed individual and collective behaviour of the victims can be located. The comprehensive nature of the model thus allows behaviour from any one period within the disaster to be placed within an outline for subsequent analysis.

(3) Social Action Perspective

Powell and Rayner's analysis allows the conclusion that many of the phenomena associated with disaster can only be understood in terms of their meanings for the affected collectivities. That is, the model defines human behaviour and social action caused by a disaster in terms of the subjective meanings the actors attach to the disaster situation. Such action also takes into account the behaviour of other actors and the model is thus oriented along this dimension as well.

The actions of human beings can be understood only if cultural definitions and the meanings implicit in personal emotions and feelings are taken into account, together with consideration of the situations in which the behaviour occurs (Morris 1977:5). Powell and Rayner's model tries to grasp the meaning of the disaster as it is lived by the people involved. This is highlighted by the definitions given to the stages of warning, threat, inventory and rescue. The emphases in these stages are the meanings of the differing situations as perceived by the participants themselves. The effort is to study disaster-related phenomena not as entities or essences in themselves, but as they are perceived by the human actors involved in the situation. The emphasis in the model is not on facts but on the meaning of the experiences the participants have undergone or are undergoing in a disaster or crisis situation. The model provides an alternative perspective to the psychological models of disaster behaviour (e.g. Lang and Lang 1964; Wolfenstein 1957; Tyhurst 1951), or the physical analyses of a disaster situation (e.g. Gutenberg and Richter 1949; Hewitt and Burton 1971; Burton and Kates 1964), models which Stoddard suggests are the least useful classification system in disaster research (1968:12). Powell and Rayner's model allows the researcher to understand the disaster situation in terms of the participants perspective of that disaster (Brown and Goldin 1973:60).

6.4 Application of the Model to Earthquakes

Although the frequency of earthquake occurrence in New Zealand is relatively great compared to other natural hazards (there are approximately 350 felt earthquakes per year in New Zealand; on average there are 3.5 floods per year (Soil Conservation and River Control Council 1957)), damaging earthquakes are much less frequent. New Zealand can expect, on average, one Richter magnitude 6 shock per year; one Richter 7 every ten years, and one Richter 8 every 100 years.

Damaging earthquakes are relatively rare natural hazards. The importance of this characteristic is that the less frequent a phenomenon, the less frequent are the occasions which the public have of being exposed to it, and thus of experiencing the effects. This leads to a lessened opportunity of being able to internalise actions that are appropriate in specific situations to mitigate or counter-act the consequence of that phenomena. It may also have important implications in relation to the application of the Powell and Rayner model, which will be discussed further in this section.

An earthquake is, at present a precipitate natural hazard. That is, it occurs without forewarning and is thus unexpected with reference to the actual arrival of the earthquake.[1] It is also a hazard that strikes rapidly (Dynes 1970: Chapter 3; Burton et al 1978:24). An earthquake may also be repetitive (Dynes 1970), that is, the disaster agent does not necessarily strike with a single impact but may occur frequently in the form of aftershocks over a prolonged period of time (the Inangahua earthquake series resulted in 809 shocks within 40 days of the main event). Because of these aftershocks, earthquakes may have a prolonged duration that extends over a period of days, weeks or months.[2] Early aftershocks are sometimes as big as the main shock itself (Eiby 1957:97), although aftershocks sequences are only present in shallow-focus earthquakes (Eiby 1957:105)[3]. In shallow-focus earthquakes, therefore, the duration of the period of danger may be unknown until the earthquake series has finished. The duration of the period of danger can only be determined in retrospect. For example, in the 2 February 1931 Hawkes Bay earthquakes (which registered 7.7 on the Richter scale) the largest aftershock (7.1 Richter) came ten days after the main seismic event.[4]

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[1] A population living in an earthquake-prone area may anticipate or expect future earthquakes, but they do not know in advance when an actual earthquake will occur.

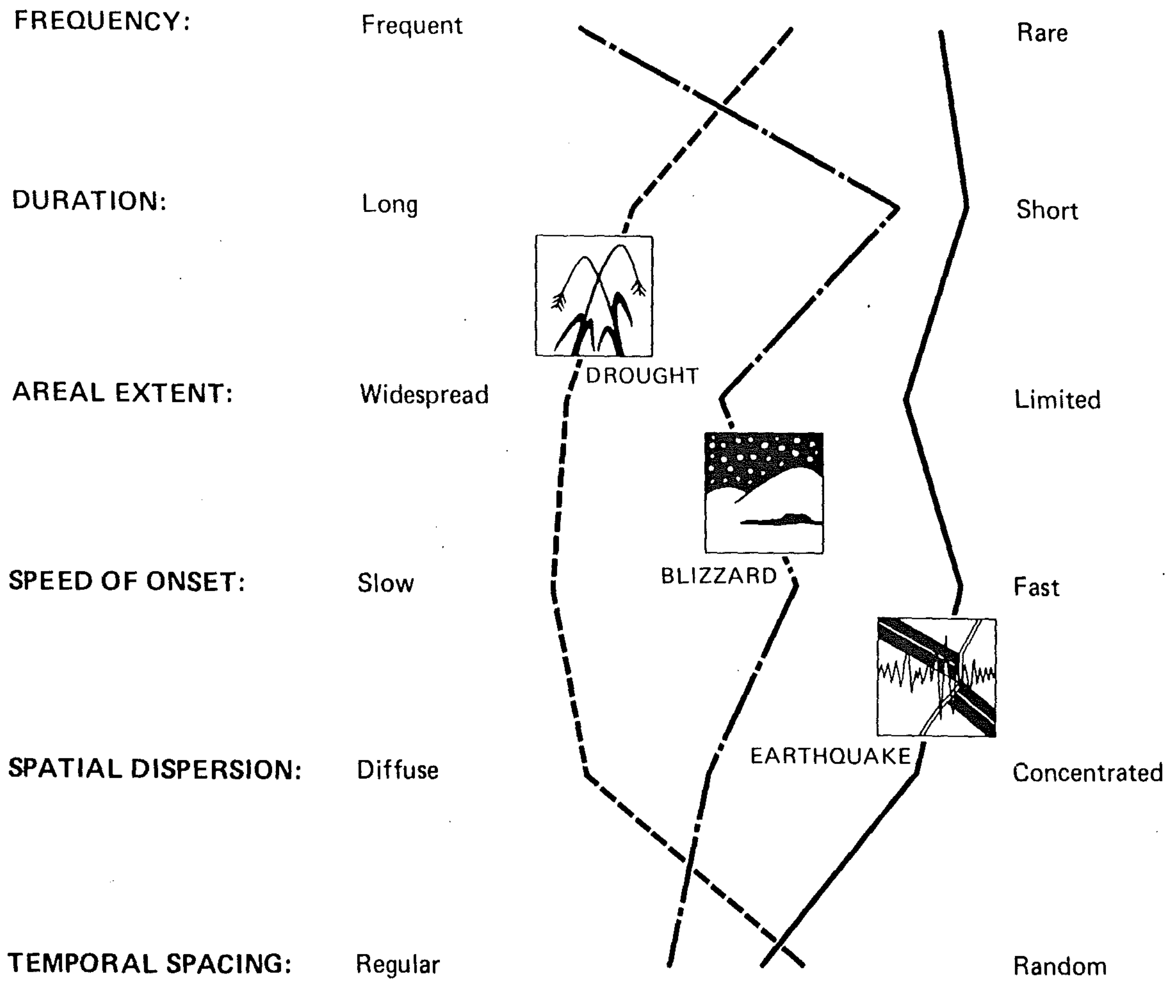
[2] The figure by Burton et al (Figure 14) suggests that either only the initial main shock has been considered in the construction of this diagram, or that the main shock plus the aftershocks do not usually result in affecting a given habited area as long as other hazards (e.g. droughts). Thus duration is relative, depending upon other hazards.

[3] Also private communication with Dr. W.D.Smith, Seismological Observatory, Wellington.

[4] Because of the inadeqaute records covering the Hawkes Bay earthquake, the damage that was caused by this particular aftershock is not known.

FIGURE 14: HAZARD EVENT PROFILES FOR CHARACTERISTIC DROUGHT, BLIZZARD, EARTHQUAKE

Source: Burton I., Kates R.W., White G.F.: THE ENVIRONMENT AS HAZARD (O.U.P.) 1978:29



HAZARD EVENT PROFILES FOR CHARACTERISTIC DROUGHT, BLIZZARD, EARTHQUAKE

It is possible to draw a profile for natural events with hazard potential and to make comparisons between events by characteristics independent of their human impact.

As Burton et al point out in Figure 14, earthquakes are usually spatially concentrated. The idea of spatial concentration is relative though. Other researchers, (e.g. Carr 1932) have suggested that earthquakes are spatially diffuse on the basis that they affect communities in totem, compared with a focalised disaster such as a mine explosion. The comparison of drought and blizzard by Burton et al implies that earthquakes are more spatially concentrated compared to the other two types of hazards. But if the unit of analysis was taken to be the community, as Carr suggests, and not a larger geographical area, as implied by Burton et al[1] then the earthquake would also be diffuse.

These four characteristics - the rarity of damaging earthquakes, no forewarning, rapidity of onset and the prolonged duration of shallow-focus earthquakes - may be features of a disaster-agent for which consequences of social behaviour and action cannot be fully integrated into the Powell and Rayner model of disaster time. With the exception of one of the above characteristics (the rarity of damaging earthquakes), the model is not entirely suitable for the study of earthquake disasters.

a) Because of the rarity of a devastating earthquake in any specific region, the impact of such an earthquake may mean that the behaviour described in Powell and Rayner's model (particularly in the inventory period of coming to an under-

[1]Assuming also that a hazard is only a hazard when it affects the human use system as well. Burton et al do not define the parameters which they have employed to determine geographical area.

standing of what has happened and taking stock of the situation) may be manifested in an earthquake-induced disaster. That is, if a damaging earthquake struck a region every 40 years, as Smith estimates is the case of a MM VII earthquake in the West Coast City of Greymouth (1976), the interval between earthquakes would be such that a new generation of inhabitants living in this area would not have experienced a sizeable earthquake. This would make the earthquake a unique experience for those people. The application of the model to a situation which involves a unique disastrous experience is appropriate for describing the social behaviour of the participants. If the disaster-agent was recurring in a given population area it is conceivable that the Powell and Rayner model would be inappropriate (for example, the pre-warning-warning-threat stages would become part of the 'normal' cultural conditions of that community. Inventory would have to be redefined with the emphasis away from coming to an understanding of what had happened).

b) and c) Earthquakes are precipitate disasters. Because of this, and because the occurrence of earthquakes is rapid, the perception of an impending earthquake is absent. This situation results in the absence of Powell and Rayner's time periods relating to warning and threat. The significance of the unanticipated occurrence of an earthquake means that Powell and Rayner's model cannot be used in its entirety. The absence of the warning and threat stages may have an effect on the subsequent behaviour of the impact population. If the post-impact behaviour as envisaged by the model is dependent on the forewarning periods, then the applicability of this model to an earthquake situation is obviously suspect (in this regard, the model may be used with more effectiveness in the analysis of behaviour in a predicted earthquake).

d) The fourth characteristic of earthquakes: that earthquake activity in the form of aftershocks, may continue for an indeterminate length of time, may cause problems for the implementation of the model to a disaster caused by an earthquake. Recapitulating on what was stated previously, because large shallow focus earthquakes (i.e. those of Richter 5 or more) are likely to come in a series of shocks, there is a high degree of probability that more than one earth tremor is to be expected. This expectation can be re-defined to suggest that in an earthquake disaster there may be repetitive impacts with cumulative threat caused by the anticipation of more impacts. Earthquake aftershocks may cause physical damage to property, and injuries, death and disorientation to individuals over and above that caused by the main event. The fact that an earthquake may cause physical damage and social upheavel through a number of impacts may cause problems in 'fitting' the Powell and Rayner model of disaster time to an earthquake-induced disaster situation. The Powell and Rayner model assumes that a disaster has a single impact, and that all social behaviour and time periods will follow from a single impact. Because earthquakes may have repetitive impacts, means that the duration of the impact phase could be extended and repeated. Hence the time period of the model may not be sequentially developed (from Impact through to Recovery) as Powell and Rayner have inferred. Repeated impact with concommitant threat may be a more appropriate typology for the study of earthquake disasters. Several impacts over an extended period will affect the behaviour of disaster victims in a way that Powell and Rayner's model does not elucidate (if, for example, the Inangahua population had not been evacuated from the impact area, and if, as was the case in the 1931 Hawkes Bay area, a larger aftershock several days after the main event occurred, Powell and Rayner's model of disaster time may not have been an appropriate model both for the periods of disaster time and as a framework for the analysis of the social behaviour of the impact-area victims). Although Powell and Rayner (1952) and Powell (1954) make provisions for earchquakes in their discussion of 'disaster types' (i.e. earthquakes are examples of a 'prolonged repetitive impact series with cumulative threat' (Powell 1954:II 16)), this type of disaster does not fit into the periods of disaster time portrayed by the model.

Problems in applying the Powell and Rayner model to a particular earthquake disaster have already been discussed. Some limitations of the model for its application to disasters in general have been stated, and, in this section, comments have been made about the appropriateness of the model to earthquake disasters. Despite these restrictions, the model nevertheless provides a working framework which can be used to analyse social behaviour in a disaster, in stages that are readily identifiable in most disaster situations. The Powell and Rayner model of Disaster Time was (the past tense is deliberate) a useful tool in the construction of more suitable and adequate models for the analysis of disaster behaviour. The refinements that have been achieved by researchers in the variations of the original Powell and Rayner model testifies its utility as a framework for disaster research.

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SKETCH OF KEY RESPONDENTS

1.	TERRY	Ministry of Works Overseer, Inangahua Camp. Married, one child ($2\frac{1}{2}$ yrs), mid-30's. Been in Inangahua for five years.
2.	FAY	Housewife, married to John.... . Inangahua Camp, one child (4 yrs), 30 yrs of age. Born in Inangahua
3.	JOHN	Petrol tanker driver, Inangahua Camp. Married to Fay... . 33 yrs of age, been in Inangahua for 18 years. Born in Westport.
4.	RAY	New Zealand Electricity Department linesman, Inangahua Hydro station, Inangahua Camp. Married, one child (9 months), mid-30's. Been in Inangahua 3 years, born in Westport.
5.	MAC	New Zealand Electricity Department Supervisor, Inangahua Hydro Station, Inangahua Camp. Married, 2 children, mid-30's. Been in Inangahua 18 years.
6.	ARNOLD	Ministry of Works employee, Inangahua Camp. Married, no children, 40 years. Been in Inangahua 10+ years. Before that Cronadun and Reefton.
7.	NOEL	Ministry of Works employee, Inangahua Camp. Married, one child (8 years), 56 years of age. Long-time resident - been in Inangahua since 2 years old.
8.	MAUDE	Housewife, Inangahua Camp. Married to Noel... . 53 years old. Resident in Inangahua 30 years.
9.	WILLIAM	Secondary School teacher (Inangahua College, Reefton), Inangahua Camp. Married,three children, mid-30's. Been in the area for four years.
10.	COLLEEN	Farmers wife, Inangahua Junction, married, four children, mid-30's. Been in area 12 months
11.	WARREN	Farm-hand on father's farm, Inangahua Junction. Married, no children. Born in Inangahua, been away to University for five years, returned three years before earthquake. Late 20's.
12.	RUTH	Housewife, Inangahua Junction, married to Warren.... , late 20's, resident in area for three years

13. KEVIN	Bushman, Inangahua Junction, married, two children, 40 years. 25 years in Inangahua. Before that resident in Westport
14. PATRICK	Farmer and Bushman, Chairman of Inangahua County, Inangahua Landing. Married, no children at home, but children living in same Valley. 70+ years of age. Resident in area 60+ years.
15. MRS. O'	Farmer's wife and former school teacher, Inangahua Landing, married to Patrick.... . 70+ years, long-time resident.
16. JIM O'	Farmer, son of Patrick.... , Inangahua Landing Married, six children, 40 years of age. Born in area.
17. SHIRLEY	Farmer's wife,Brown Creek Road, married two children, 30 years of age, born in Inangahua
18. LES	Farmer, Buller Gorge, three miles from Inangahua Junction, married, five children, 50 years of age, twenty years in the region.
19. NOLA	Farmer's wife, Buller Gorge, married to Les... , 48 years, twenty years in the area.
20. PETER	Farmer, New Creek, married, four children, 40 years of age, Dutch emigrant, Been in New Creek 10+ years.
21. LISA	Farmer's wife, New Creek, married to Peter... , 40 years, Dutch emigrant, Been in New Creek 10+ years.
22. ROSALIE	Farmer's wife, New Creek, married, three children, 22 years of age, resident in New Creek and Reefton area 8 years.
23. VERNON	Farmer, New Creek, married to Rosalie..., 32 years of age, born in area.
24. KATHLEEN	Farmer's wife, New creek, married three children, mid-30's, been inthe area for 20 years.
25. JIM	Town Clerk, Reefton, in hospital at time of earthquake, discharged himself and assisted Civil Defence Controller.
26. DON	Deputy Controller Reefton Civil Defence and Registration Officer, Reefton
27. MURRAY	Police Constable, Reefton, Civil Defence Communications Officer.

28.	GAVIN	Minister of Religion, Westport, President of Red Cross, Westport Branch.
29.	TOM	Country Engineer, Deputy Civil Defence Controller, Buller Combined District, County Representative, Westport.
30.	DENZILL	Civil Defence Controller, Westport, Buller Combined Civil Defence District.
31.	OSWALD	Deputy Mayor, Greymouth, Second-in-Command Civil Defence, Greymouth.
32.	MAXWELL	Police Sergeant, Greymouth, Police Liaison Officer, 1968 operation at Inangahua disaster.
33.	SELWYN	Ministry of Works Hydrology Engineer Christchurch, Consultant to Civil Defence and Ministry of Works, member of Reconstruction Committee.
34.	GORDON	Senior Traffic Officer Greymouth. NOW Assistant Commissioner of Civil Defence, Southern District, Christchurch.
35.	COLONEL McCALLUM	Present (1979) Commissioner of Civil Defence Southern District, Christchurch.

University of Canterbury Christchurch 1 New Zealand

DEPARTMENT OF SOCIOLOGY

6 June, 1978.

Dear

I am conducting research, as part of my thesis for a Master of Arts, into the 1968 Inangahua earthquake.

The primary intention is to analyse the earthquake situation in its social context. In order to achieve this, I require material on different aspects of the Inangahua earthquake These include material on:-

1) the physical and economic effect of the earthquake: That is a blow-by-blow account of the earthquake and its effect on the physical structure and the economy of the area.

2) the social effects of the earthquake on the community: For example,
   - how the community members reacted to and coped with the earthquake and it's consequences.
   - the deaths and injuries sustained.
   - the psychological disturbances incurred.
   - the effect of the disorganisation and disruption.
   - the impact and effect of such losses, and
   - the duration of the damage and losses.

3) how community members organised themselves in the face of disaster from the moment of impact to the end of the recovery and reconstruction period.
   - what external agencies aided in this organisation/reorganisation.

4) what modifications were adopted as a result of the earthquake:
   - what lessons were learnt,
   - what organisations adopted new procedures or regulations etc.
   - what new or revised statutes resulted from the 1968 earthquake.

If your Department has any data that will aid this study, I would be very grateful for a copy of it or access to it. It may be that some of this information is in unpublished form and is kept in your Department's files. If so, would you inform me whether it is possible to obtain access to those files for the purpose of my research.

University of Canterbury Christchurch 1 New Zealand

If your Department is aware of any other personnel or organisation that could supply any of the information I am seeking, I would be pleased if you could put me into contact with them.

Thank you in anticipation of your reply.

Yours sincerely,

Neil R. Britton,
Teaching Fellow,
Department of Sociology.

University of Canterbury Christchurch 1 New Zealand

DEPARTMENT OF SOCIOLOGY

28 September, 1978

Dear

I am conducting research concerning the 1968 Inangahua earthquake for my Master of Arts thesis. Primarily, I am looking at the social effects of the earthquake on individuals and on the community-at-large. With this in mind, I require some material that can only be obtained from persons that have been subjected to the actual earthquake.

If you were in the Inangahua area at the time of the earthquake would it be possible for me to call on you and talk about the event? If this is a possibility, could you please indicate by writing back to me in the stamped envelope to let me know of your decision. I expect to be in the Inangahua region within four to five weeks, that is, in October-November of this year. The interview will not take long, and all information will be confidential.

I hope you will assist me in this study and realize the importance of being able to talk with you on this matter. I look forward to your reply. Thank you for your assistance.

Yours sincerely,

Neil R. Britton
Teaching Fellow,
Department of Sociology

University of Canterbury Christchurch 1 New Zealand

DEPARTMENT OF SOCIOLOGY

26 October, 1978.

Dear

Thank you for your reply to my request for an interview with you concerning my research on the 1968 Inangahua earthquake. This is just a note to tell you that I will be in Inangahua next week - Thursday 2nd November to the Sunday, 5th November inclusive. I will be staying at a hotel in Reefton as I understand there is no such accommodation available at Inangahua.

I am looking forward to meeting you.

Yours sincerely,

Neil R. Britton,
Teaching Fellow,
Department of Sociology

Earthquake magnitudes, energies, effects, and statistics.

Characteristic effects of shallow shocks in populated areas	*Approximate magnitude*	*Number of earthquakes per year*	*Energy (ergs)*
Damage nearly total	≥ 8.0	0.1–0.2	$>10^{25}$
Great damage	≥ 7.4	4	$\geq .4 \times 10^{24}$
Serious damage, rails bent	7.0–7.3	15	$0.04\text{–}0.2 \times 10^{24}$
Considerable damage to buildings	6.2–6.9	100	$0.5\text{–}23 \times 10^{21}$
Slight damage to buildings	5.5–6.1	500	$1\text{–}27 \times 10^{19}$
Felt by all	4.9–5.4	1,400	$3.6\text{–}57 \times 10^{17}$
Felt by many	4.3–4.8	4,800	$1.3\text{–}27 \times 10^{16}$
Felt by some	3.5–4.2	30,000	$1.6\text{–}76 \times 10^{15}$
Not felt but recorded	2.0–3.4	800,000	$4 \times 10^{10}\text{–}9 \times 10^{13}$

Source: Data from B. Gutenberg.

APPENDIX: page 298
THE RICHTER MAGNITUDE SCALE
based on the amplitude of
seismic waves.
Source: Press F.& Siever R.
EARTH (W.H.FREEMAN & COMPANY;
1974:639

APPENDIX: page 299

THE MODIFIED MERCALLI INTENSITY SCALE

Source: Weisbecker L.W. *et al* 1977:11

To eliminate many verbal repetitions in the original scale, the following convention has been adopted. Each effect is named at that level of intensity at which it first appears frequently and characteristically. Each effect may be found less strongly, or in fewer instances, at the next lower grade of intensity; more strongly or more often at the next higher grade. A few effects are named at two successive levels to indicate a more gradual increase.

Masonry A, B, C, D. To avoid ambiguity of language, the quality of masonry, brick or otherwise, is specified by the following lettering (which has no connection with the conventional Class A, B, C construction).

Masonry A. Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.

Masonry B. Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.

Masonry C. Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.

Masonry D. Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

I. Not felt. Marginal and long-period effects of large earthquakes.

II. Felt by persons at rest, on upper floors, or favorably placed.

III. Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration may be estimated. May not be recognized as an earthquake.

IV. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV wooden walls and frame creak.

V. Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

VI. Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle — CFR).

VII. Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments — CFR). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.

VIII. Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

IX. General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations — CFR). Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, earthquake fountains, sand craters.

X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.

XI. Rails bent greatly. Underground pipelines completely out of service.

XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Source: C. F. Richter, "Elementary Seismology," pp 136 138, W. H. Freeman and Company, San Francisco, 1958.